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THE
PRINCIPLES OF SURGERY,
in
TWO VOLUMES:

VOLUME FIRST;

OF THE ORDINARY DUTIES OF THE SURGEON,

CONTAINING THE PRINCIPLES OF SURGERY, AS THEY RELATE TO WOUNDS,
ULCERS, AND FISTULAS; ANEURISMS, AND WOUNDED ARTERIES, FRACTURES OF
THE LIMBS, AND THE DUTIES OF THE MILITARY AND HOSPITAL SURGEON.

VOLUME SECOND;

A SYSTEM OF SURGICAL OPERATIONS,

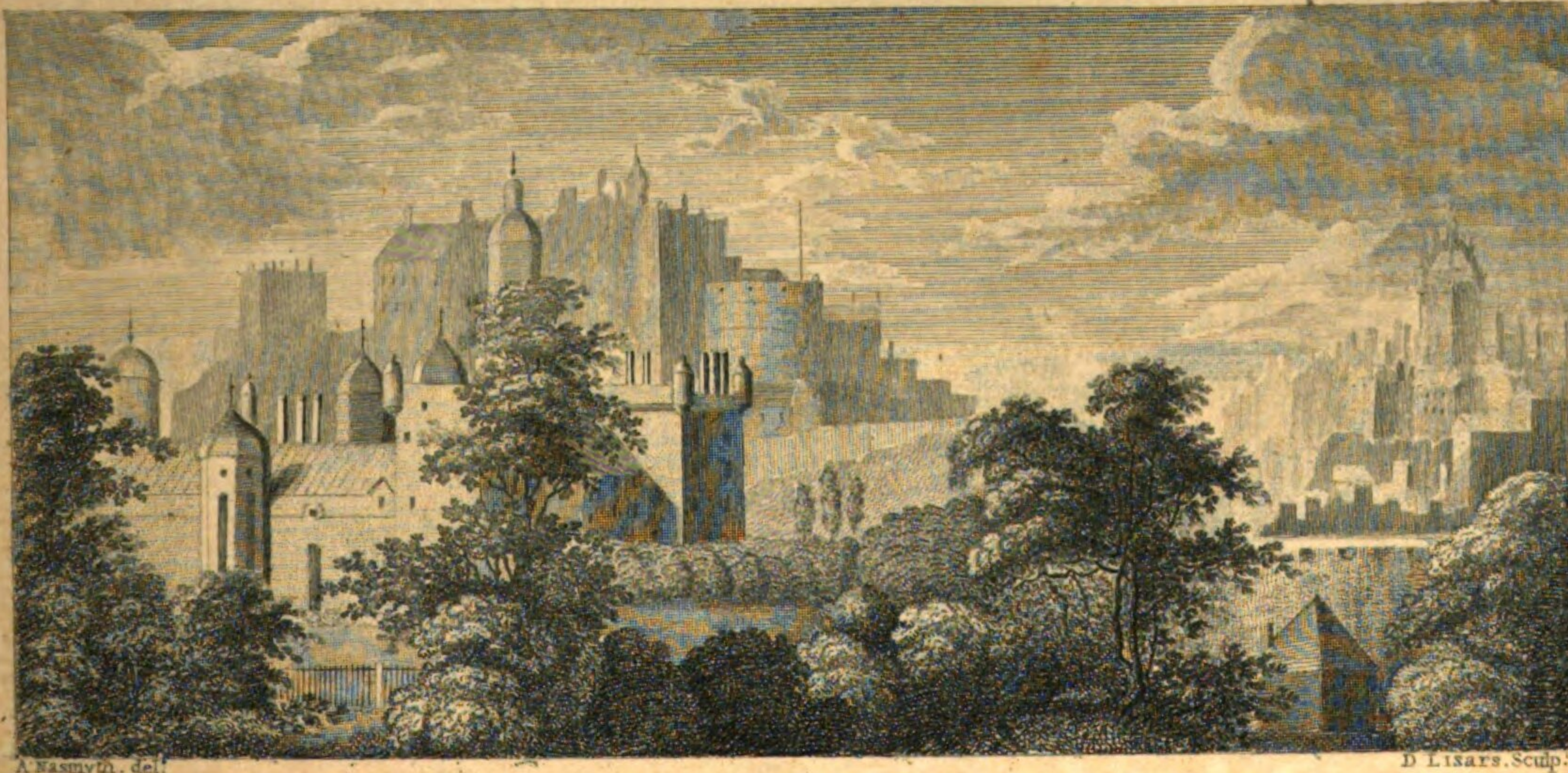
CONTAINING THE PRINCIPLES OF SURGERY, AS THEY RELATE TO SURGICAL
DISEASES AND OPERATIONS, AS LITHOTOMY, TREPAN, HERNIA, HYDROCELE, AMPUTATION, &c.

BY

JOHN BELL, SURGEON.

“Who would lose,
“For fear of pain, this intellectual being?”

Bell
The Principles
of Surgery

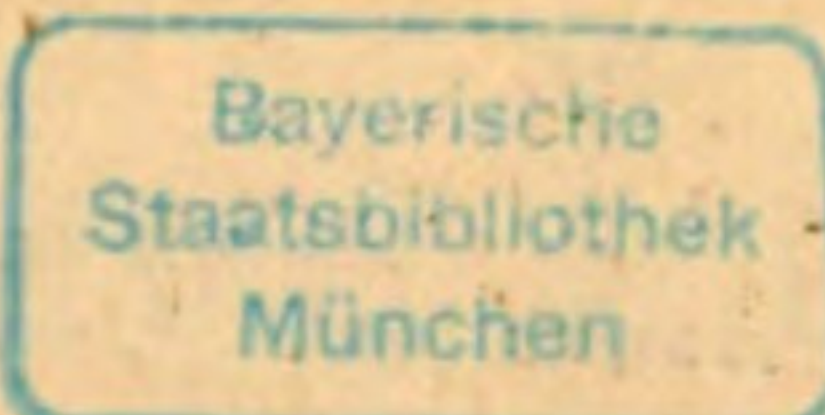
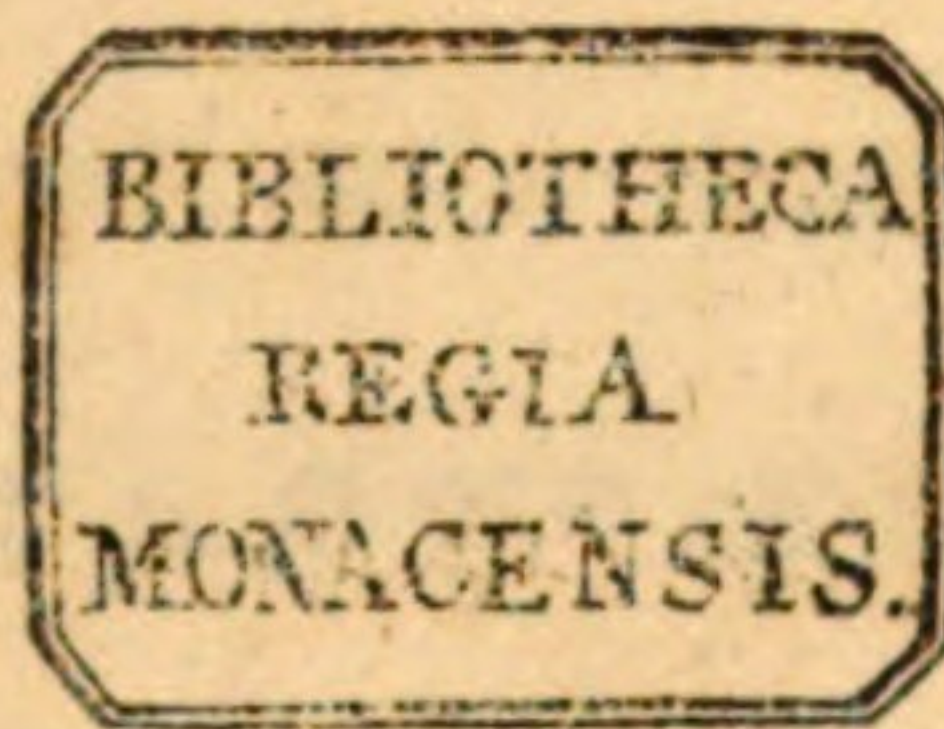


EDINBURGH.

Printed for T. Cadell, jun. & W. Davies, in the Strand, T. N. Longman & O. Rees, Paternoster Row London;
and W. Creech, P. Hill, and Manners and Miller.

1801.

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TO THE SURGEONS OF LONDON,

AND IN A PARTICULAR MANNER,

TO DR. MATHEW BAILLY, MR. LYNN, OF WESTMINSTER HOSPITAL,

MR. WILLIAM BLIZZARD, MR. ASTLEY COOPER,

AND

MR. ABERNETHY OF ST. BARTHOLOMEW'S,

THIS BOOK IS PRESENTED BY THE AUTHOR,

WITH EVERY SENTIMENT WHICH THE REMEMBRANCE OF

THEIR HOSPITABLE, KIND, AND LIBERAL CONDUCT,

SHOULD INSPIRE.

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ADVERTISEMENT.

THE Author will make no apologies for a book which is too long not to have many faults; he presumes to offer it to the Public as a proof of his diligence and love of his profession, to his Pupils as an act of respect and duty, and he has dedicated it to men of liberal minds, zealous for the improvement of Science, who have been pleased to think very favourably of his former efforts; who know how to excuse whatever they find in this Volume unworthy of them or of the Author; who know also how to receive this token of esteem and friendship, not according to its real value, but the spirit in which it is presented.

The Author hopes his book will be found to be written in a liberal manner, representing the History, the Theories, the Rules, and the Actual Practice of Surgery, in one connected view. Amidst unavoidable speculations and occasional illustrations of various kinds, he has never lost sight of practice; he has endeavoured to improve the minutiae of surgery, to give importance to the most ordinary duties of the surgeon, and to teach young men to practise their profession with humanity, zeal, and charity. He has in this Volume laid down the Principles of Surgery, as they relate to the three great subjects of Wounds, Aneurisms, and Fractures; the next Volume will contain a circle of Surgical Operations; and although, in appearing again before the Public, he must feel some selfish anxieties, yet there is one thought very natural on this occasion, which it cannot be unbecoming to express: The Author wishes sincerely that the errors of his book may belong only to the form and composition, not to the matter of it: Such errors, however dangerous to the Author's reputation, will not mislead the young surgeon, for whose use this system is designed.

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ON THE

EDUCATION AND DUTIES OF A SURGEON.

I AM now entering, Gentlemen, upon a course of Surgery, which will be of little service to you, unless I lead you onwards by gradual steps from theory to practice; from the common principles of Surgery, and the most ordinary duties of the Surgeon, to those important operations which it is sometimes our duty to perform. In every profession, the daily and common duties are the most useful; and in ours, the man who is capable of the great operations rises into public esteem, only because it is presumed, that he who is the most capable in the higher departments of his profession, will best perform all its ordinary duties.

Yet such is the natural horror at blood, and the hesitations and difficulties of the Surgeon himself when any thing so daring as a dangerous operation is to be done; and such are the unceasing and anxious inquiries of friends, that operations, though the least part of our profession, strike a deeper interest into the public mind than the daily cures we perform. Operations usurp an importance in Surgical Education which they should not naturally have. Operations

have come at last to represent as it were the whole science; and a Surgeon, far from being valued according to his sense, abilities, and general knowledge, is esteemed excellent only in proportion as he operates with skill.

On a future occasion I shall have much to say to you on this very subject; at present, it is more natural, I believe, to offer you some rules, not for the practice of your profession, but for the study of it; for if you study with real diligence, according to a sensible plan, those good dispositions will naturally grow up which every friend, which every teacher would wish you to cherish; you will feel a generous disregard of every thing but opportunities of doing good, and promoting to the utmost of your power, the interests of humanity, of your profession, and of general science. From the cause of science never allow yourselves to be separated by any selfish or partial views: From the day in which you devote yourselves to a profession which brings with it indelible cares and difficulties, never cease to think how you are to support its interests, and to contribute each of you in his own private station to make the profession honourable, as well as useful. Such is the connexion of every individual with the art or science to which he belongs, that were his profession generally despised, his most honourable exertions would be of no avail. It is surely then no affectation to say, that I take the most sincere interest in your studies, your successes, and your honourable conduct in the world.

I have been accustomed to regard the public service of the State as a great school of practical science, as offering opportunities which more than compensate the toils, the hardships, and the dangers of that way of life. It is a school where a young man, after a respectable education, is sure, while he improves in his profession, to acquire liberal principles, polite manners, and a knowledge of the world. The situation of a Military Surgeon is more important than that of any other; while yet a young man, he has the safety of thousands committed to him in the most perilous situations, in unhealthy climates, and in the midst of danger. He is to act alone and unassisted, in cases where decision, and perfect knowledge are required; in wounds of the most desperate nature, more various than can be imagined, and to which all parts of the body are equally exposed; his duties, difficult at all times, are often to be performed amidst the hurry, confusion, cries, and horrors of battle. Even in the seasons of the greatest difficulty, cold and heat, hunger and fatigue, vexation of mind, and all the distresses of foreign service, aggravate disease; and, while

they render his exertions of so much importance, teach him imperiously, the necessity of an accurate and ready knowledge of his profession. It is to him that his fellow soldiers look up at the moments of distress: his charities and his friendships are prized beyond all price! What part of education is there, needful or even ornamental, for the Surgeon living at his ease in some rich luxurious city, which the Military Surgeon does not require? What qualifications, of the head, or of the heart? He has no one to consult with in the moment in which the lives of numbers are determined! He has no support but the remembrance of faithful studies, and his inward consciousness of knowledge; nor any thing to encourage him in the many humble yet becoming duties which he has to fulfil, except his own honest principles and good feelings.

I know your minds go willingly along with me when I speak of those duties which agree so well with the ardent and generous temper of youth. While you are young, enter into the service of your country! It is a school, of practice in your profession of prudence, good conduct, and knowledge in the ways of the world. A young man ripens amidst those actual services for the important period (to himself at least most important), when he is to take his permanent situation in life. It is a school, where he who has a good education, just principles, and a feeling heart, improves in all that can make him beloved or respected when he returns home to his friends. And if during his years of service he meet occasionally with distress and danger, this too is good. "Sweet are the uses of adversity."

The very men who are now the chief authorities in surgery, who alone of all the writers of the last age are admired and appealed to, were bred in this school. Petit, Garengeot, Dionis, Heister, Le Dran, were the army surgeons of France, and learned, in the field, that surgery from which the trivial books of the present day are immodestly and poorly copied. Our great surgeon Wiseman was bred amidst the horrors of our civil wars, serving a long and weary apprenticeship to that profession in which at last he attained to an eminence unequalled by any man since his time. Heister tells us how he learned his profession. He seems to have been a very young man, poorly supported, but of unsubdued spirit. "Exposed (says he) to many dangers and hardships, thus did I spend my summers in the hospitals of the camp for the sake of improvement." During many years he studied anatomy under Ruisch, Raw, Albinus, and Bidloo, in the winter season, and returned in summer to the field, and even after he was appointed to succeed his master Raw, in lecturing on anatomy; as soon

as his winter labours were over, he repaired every year to the camps, and hospitals.

It was an enthusiastic desire of learning his profession that induced Paræus to follow the French armies while yet very young; and we have a singular testimony of his early abilities from an old physician, who, after the taking of the city of Turin, always called for young Paree "when any great surgical work was in hand, because he was delighted with the bold and spirited manner in which he performed all the great operations." To the *Signeur le Marechal Montjan* this old physician said at parting, "My Lord, you have got a surgeon young in years but old in experience and wisdom. Keep him carefully, for he will do you both service and honour." Paree himself tells this tale of his early days in the mere garrulity of old age, but along with this ebullition of vanity there is good sense and even modesty; for he adds soon after, "But the good old man did not know that I had lived three years in the *Hotel Dieu* attending the sick." Paree began his career in the *Hotel Dieu*. He performed there many operations upon the living, and learned much of anatomy from the dead body. He perfected himself by practising in the camps and armies, and having lived in familiar society with the king and nobles of France, he finished a long, honourable, and busy life, in the city of Paris. It is seen in the history of the French Academy, that the princes and generals of France willingly took the field when they could prevail upon Paree to go out along with them; and at the time when all the noblesse of the kingdom were shut up in Mentz, which was besieged by Charles V. in person, at the head of 100,000 men, they sent a sort of embassy to the king their master, beseeching him to send Paree to them. An Italian captain, for a great reward, introduced him into the city. They instantly sent at midnight to awaken the prince, who commanded the city, with the good news of his arrival. The governor begged of him that he would go next day and show himself upon the breach. He was received with shouts of triumph; Mentz was then the bulwark of France; and it has always been ascribed to the presence of this single man (so perfect was their confidence in him), that they kept the city till the gallant army which lay around it, perished beneath its walls.

Who could desire a more lasting fame than these men have left behind them. They followed the armies not for pay nor pensions, but out of pure love for their profession. They sought improvement, impelled to it by being already thorough-

ly educated in all kinds of study. Their skill was founded on experience, and that again on the surest of all grounds, a perfect knowledge of anatomy. These are the authors who have written with character, precision, and truth. Upon minds less ardent, less improved by study, the best opportunities are but thrown away; therefore let this be a motive with you for unremitting diligence. Be careful to be early and well prepared for these important scenes, able to do good service to the state, and capable of improving your own minds. At this present time you must feel chiefly the uneasiness of your tasks; it is in your after years that you are to enjoy the proud superiority of a good education.

Above all, improve yourselves in anatomy. It was by their knowledge of anatomy that Paree, Dionis, Heister, Wiseman, Le Dran, were distinguished among hundreds of other surgeons in the camp; this was, in their own opinions, the point from which their professional excellency and public character arose; a character founded, not on the patronage of the great, nor on high appointments, but on severe previous study. And be it your comfort to know, that they were just as you are; it was their own intense diligence, and above all their acquaintance with anatomy, the very basis of our science, which made them the first surgeons in the chief cities of Holland, England, and France, the best authors in their own day, and the highest authorities in ours.

Anatomy has always been acknowledged as the basis of all medical education. In those days when surgery had not any respectable rank in general science, the physicians, who were anatomists, taught the surgeons. The surgeons were but their servants, assistants, and operators. When the surgeons began to learn anatomy, their part of the profession began to improve; for it was then only that anatomy and surgery, the theory and practice, were rightly combined. In the early days of surgery, every book was regularly prefaced with a system of the anatomy of the human body; and if this prelude be omitted now, it is because anatomy is become, in itself, an important study. It is not by sketches and slight views, that a surgeon can become truly accomplished in it. Every one is presumed to be thoroughly informed in that study, which contains the elements of surgery and of all medical science. Anatomy, I repeat it, is indeed the basis of medical education, the only one which will be acknowledged by any sensible and well informed man. Chemistry, physiology, pathology, all look back to the structure and functions of the human body, and twine themselves round this great trunk.

If a surgeon ignorant of the parts of the human body, should be called to perform even an established and regular operation, which he has often seen performed; How must he tremble at the thoughts of what he has to do! Faltering and disconcerted! hesitating at every step! Acting only as he has seen others act, he is interrupted, startled, perplexed with every new occurrence. He has foreseen nothing, provided for no accident, and every accident alarms him. He moves fearfully and timorously onwards, like a blind man who walks with an air of confidence on an accustomed road, but when any new object presents itself, or the road is changed, is bewildered and lost.

In cities, indeed, we see untaught men operating upon their fellow creatures, in cases of life and death, in aneurism, lithotomy, hernia, trepan, without the slightest knowledge of the anatomy of the parts, much less any right ideas of their conditions, and new relations to each other in the state of disease. But such operators are seen agitated, miserable, trembling, hesitating in the midst of difficulties, turning round to their friends for that support which should come from within, feeling in the wound for things which they do not understand, holding consultations amidst the cries of the patient, or even retiring to consult about his case while he lies bleeding in great pain and awful expectation; and thus, while they are making ungenerous struggles to gain a false reputation, they are incurring reproaches which attend them through life. But a military surgeon cannot even do this. In the time of his greatest difficulties, he is unsupported and alone. He cannot, when performing trepan or amputation, turn to his servants to ask advice; and if, in dilating a wound, or searching for a ball, he cut the femoral artery, or any of its great branches, you know what will happen. In his irregular unpremeditated operations, life is saved or lost by one glance of his eye, and one turn of his hand; he strikes the axillary artery, and his patient is safe; he loses it, and his patient expires!

Those very men who sit down deliberately to perform operations which they have never tried, if they were requested to do any trifling thing in the most ordinary matters, would never scruple to say, I have not tried it! I have not been at the pains to learn it! or, if they had been apprenticed to any ordinary trade, they would practise long before they would think themselves perfect workmen, or fit to perform before others. Yet these imperfect workmen in our trade daringly practise upon their fellow creature, performing on him, with profane hands, operations which they have only heard of, or perhaps read about! and

that not much! which they have never performed upon the dead body. It looks as if they threw aside all conscience, all humanity, all feeling towards their fellow creatures, and said within themselves, "The blood and the cries will hide every thing that is wrong."

But in this matter, Gentlemen, there can be no mistake. It is to those only who are skilled in anatomy, that we ourselves would trust our health in case of disease, or our persons in any great operation. Even the ill judging world decides exactly thus; for Power, blindfold and undiscerning as it often is, may put unworthy men into places of trust and honour; but can it procure for them confidence, and the public esteem, or that character and lasting reputation which will always, I hope, be dearer to you than mere gain? By being so much exalted, they are but the more degraded. "Poor rich men!"

It is this knowledge of anatomy that has made the great surgeons of this and other countries respected in their own days, and remembered in ours. This consecrates their works, and marks them with the seal of sterling merit; by this their fame will be preserved in all times; and while we read their writings with unabating pleasure, may we not learn to follow them in the same honourable path, and, like them, pursue the true way to be great in our profession?

No sooner do you take up the works of any author, and read them with proper diligence, than you perceive, from the very forms of his books, the order and character of his studies. If he be a man unlearned in his profession, and have (as is but too much the custom), learned it by hearsay only, his tedious unmeaning books will be soon thrown aside, they will indeed seldom fall into your hands. But if he be a perfect surgeon, like those whom I delight to set before you as examples; then you will find all his remarks arranged, explained, illustrated, and enforced with peculiar ardour; his perfect knowledge of the human body brings all his experience into the most useful forms; his histories are plain and important; he dwells with judgment upon those points which are peculiarly difficult, and resolves them, by continual reference to the structure and functions of the parts. The most surprising cases become credible, when he relates them; the most ordinary facts become instructive; we never read such an author without pleasure as well as instruction; at every turn, in every difficult question, we perceive his superior penetration, knowledge, decision, good conduct. But far otherwise is it when we read the books of some others, whose

histories are merely surprising tales, to which the want of anatomical knowledge, gives an air of idle romance.

Pathology, or the diseased states of the human body, must also be with you a principal study, for that will serve as the basis of well founded confidence in yourselves, and of inexhaustible resources in occasions of difficulty or pressing danger. Do not let any man persuade you that theories are of no avail. The comparing of diseases and wounds with the natural form, sound constitution, and healthy actions of the part, forms a kind of theory which will not deceive you; and while you are studying such subjects, you are digging for the hidden gold which you will surely find, though not in the exact place or form in which you expected to find it.

General theories indeed are often but the works of idle men, of those who want industry or knowledge for searching into particulars, who are hurried away by an imagination too rapid, and too fervent to be useful, in a profession like ours; of men "who fill their books with toys, and lies, and vain conceits." But particular points should be studied by the young surgeon with unremitting diligence; and he who has a command of particular points, who has so combined anatomy and pathology, that he can revolve each case, and each accident of a case, in his mind, till it become quite plain and easy to him; will not fail to have a formed and habitual taste for great and general views; and an intelligence in all the great points of his profession, far excelling, in sound sense, and sober usefulness, the wild unfounded conceits of professed theorists.

Pathology is the work of the mind operating upon facts, comparing the sound and healthy structure with the state of disease. Every man will reason well and truly, in exact proportion to his acquired knowledge, and will act with sense and prudence, in exact proportion to his sound reasoning. The most uninformed reason according to their degree of knowledge. They reason seldom indeed, and their minds are not much engaged; they are never warmed by love of their profession, their exertions are without enthusiasm. But if you put in motion one whose mind is improved by study, and ripe for practice! his powers rise in every perilous or agitated scene; his mind, even in the midst of confusion, and while he is busy with his hands, is turning continually from point to point, from speculation to speculation. His reasoning is rapid and sure. It is like instinct, direct, active, effectual. He thinks, judges, resolves, and acts at once. He reaps advantages from pathology, which (in the time of

his studies) he did not believe to be so closely allied to practice; he goes onwards with an intrepidity, security, and firmness, which he is delighted to feel. It is in the midst of these scenes of difficulty that such a man, so educated, so inspired, comes to be truly known.

Anatomy and pathology are studies to which you will be easily persuaded to direct your attention; and you find indeed in every book some instruction on these points. But the very highest study of all, I mean the HISTORY OF OUR SCIENCE, is much neglected. I know that you are well prepared to receive ingenuously, in sincerity and kindness, whatever I have to say to you on these interesting subjects; and therefore I will mention to you, that it is too much the temper of our times to be satisfied with superficial and imperfect studies; with such scanty gleanings of knowledge as are to be gathered from mere school books, and from the mouth of a teacher. Indeed, it is with us now as in those times when books were scarce, when printing was not yet invented, when a single physician presided over a whole country, and having acquired a reputation, perhaps by some extravagant fantastic doctrine, was enabled to gather round him a number of young men, and thus he formed a school, whose dogmas altered not; whose pupils were not allowed to range beyond that magic circle which their master had drawn round about them. I believe I do not judge too hardly when I say, that by all appearance there are many, in the present day, who are contented to learn the most arduous of all sciences "by hearsay and report!" by talking about it! by walking the wards of hospitals, or lounging through the classes of a college, and by hearing and repeating the news of the passing day. This scanty and vulgar kind of knowledge is but ill calculated to inspire a man with the love of his profession, or make him really deserving of confidence and respect. Remember that severe reproach with which Van Horne brands the name of such an author, *De Saporta supra dictum est, nihil illum sapere, præ vulgo* *.

But I am to explain to you the importance of studying the history of our science. We have lying before us, challenging us to diligence, all the successive improvements of two thousand years. The study of these calls into action every faculty of the mind, fertilizes the invention, ripens the judgment, and makes us really fit to decide upon the modes and practices which are to be preferred. By this exercise of the mind we become familiar with difficulties; for while we

* Microtechnie, p. 528.

are studying the history of science, all the most nice and important points are presented to us again and again, and discussed by various judgments and in various forms.

The truth is, that the practices and the prejudices of the old times mix themselves with the more orderly and perfect operations of the present day; and this is a subject of study which we must not neglect. We have now leisure to observe, how slowly diseases have been understood, or operations invented or improved; we can remark how slowly and how imperfectly anatomy has been applied even to this day; at this moment we are employed in rooting out the prejudices and barbarous practices of those Gothic times! For the practice of the older surgeons was marked with all kinds of violence; an indifference about the simple cure of diseases; and a passion for operations, as the cutting off of limbs, the searing of arteries, the sewing of bowels, the trepanning of skulls round and round, and all the excesses and horrors of surgery.

Is it not most unaccountable to see men among us expecting to excel in a profession which they have not studied? eager to be known as improvers without having ripened their minds by studying the inventions of others? vain of their opinions, practices, and pathologies of diseases, in which they are often excelled and anticipated by authors which they have never read? Many a busy creature do we see proclaiming as fine inventions of his own! instruments or operations which have been described, drawn, commented upon, condemned, neglected, and revived again, centuries before this new inventor of old things, was himself born. While he troubles the world with his novelties, he has every fault but that of designing ill, or committing any wilful plagiarism; he is innocent of the knowledge of all old inventions. Whoever has thus neglected to study the history of our profession, has a narrow mind, and prefers the little opinions of his particular master, to the accumulated wisdom of ages; he dwells with enthusiasm upon those theories which have taken first possession of his mind, and never is he able to emerge from the atmosphere of the particular school in which he was bred.

It is to be observed, that ours is a profession which is disgraced with more ignorance and error, extravagance, fanaticism, and nonsense, than is to be found in all the circle beyond it, whether of science or of common life; and it is by this study of its history that just principles are to be established, mistakes corrected, and prejudices done away; even to understand the common matters, we must enter into

the details of science ; and while I lead you through “ all the laughable and all the loathsome familiarities” of our profession, it must not be always in a solemn and serious mood. Every subject has its appropriated language, and it is not more truly the mark of wisdom to be grave on serious occasions, than it is the sign of folly to affect the same unaltered gravity on occasions where we may lawfully be amused as well as instructed. There is in the history of our science much to amuse us, but there is much also to bring us back to a sober, thoughtful state of mind, and I hope there is no man more apt to be seriously impressed with serious matters than I am. As your teacher, it becomes me to address you in that language which the occasion requires, with familiarity sometimes, but more frequently with the seriousness of an earnest friend ! When I tell you to despise authority, I shall at the same time teach you to respect science, and to cherish in yourselves a love of truth, an ardour in study, a proud opinion of your profession, and a sincere diligence in all the duties of it.

Much has been said about the qualifications of a surgeon, as if nature had not endowed us all with abilities equal to the common and necessary duties of life. On this favourite theme, however, authors have descanted to little purpose, for those qualities which are most loudly praised, are such as cannot be acquired, and have little relation to the abilities, dexterity, or knowledge of a surgeon. The elegant description of Celsus is not judicious, although it suits the times in which he wrote : when surgeons were chiefly the servants of physicians, who required of them chiefly a quick eye and a steady hand, and that unfeeling hardihood, which is so well described by the “ *manu strenua stabili nec unquam intremiscente, animo intrepidus immisericors.*” By such descriptions surgeons are disgraced not praised, and the modern surgeons, in repeating this description, have but caricatured the classic picture of Celsus. The *bonam formam, oculos claros, manus firmas, digitos graciles* of those Gothic successors of Celsus, are rather directions for choosing a nurse or paramour ; yet many an awkward fool, when he was writing such silly things, thought he was describing “ his own fine parts and pretty person.”

I would have you to dwell with confidence on this, that all that is essential to the character of a good surgeon may be acquired. To think otherwise, were as discouraging as untrue. The eye is in the mind. A learned eye is a discerning and a quick one. And his hand will not easily tremble who knows perfectly what the hand should do ! what the hand may do ! Study well the es-

essentials of your profession, learn your duties and trust the rest to nature. For be assured that dexterity and boldness follow judgment and skill as closely as the shadow does the substance. Though the qualifications of a surgeon are not to be acquired, yet assuredly they may be improved; and he will be disappointed who waits for a sort of inspiration, and expects to find in himself naturally and without practice, a quick resolution, a judicious eye, or a dexterous hand. He may believe himself dexterous without knowledge, but it will be mere whiffling agility and charlatan trick, in place of masterly and deliberate boldness.

But boldness is a seducing word, and the passion of acquiring character in operations is surely full of danger; it is fit for those only to profess, who have no higher claim to the public esteem. We are but too apt to allow the audax in periculis to be the character of a good surgeon. But this is a temper of mind and a line of conduct which can benefit nothing but the character of the surgeon himself; for as to his patient, this shameless thirst of fame! this unprincipled ambition, is full of danger. I would say rather with Guy De Chauliac, Sit audax in securis, timidus in periculis; let him cut rapidly and dexterously where all is safe, slowly and cautiously where there is danger. He should not, where quickness can do no harm, torture his patient and protract his pain with foolish and conceited tricks; such affectation of dexterity is but a pitiful ambition in those who use it. Nor should he in any doubtful case endanger his patient merely to gratify the fools who estimate his dexterity by no other criterion than the stop-watch; the patient commits himself into the hands of his surgeon, constitutes him judge in all difficulties; and would willingly endure a more severe and lingering operation if there appeared circumstances of peculiar danger. Should not then the present suffering of the patient, the sense of his own duty, and above all the trust that is reposed in him, occupy the surgeon's mind too much to leave room for vain or selfish thoughts? Yet we every day see surgeons cutting out harmless tumors with affected and cruel deliberation, and in the same hour plunging a gorget among the viscera with unrelenting rashness.

Believe me, those qualities which relate to operations and other public exhibitions of skill, are of a very doubtful kind, while the duties of humanity and diligence are far more to be prized; they are both more amiable and more useful. For an example of this, and of every thing great in our profession, I go at once to Paree, who was more humble, more charitable, more affectionate towards the poor, than (it is to be feared) those who live with kings and princes usually are;

for Paree was the familiar companion of princes, and yet was not careless of the poorest fellow that followed in their train. In what I am now going to relate to you, you will learn how much a sensible, active, humane surgeon may be able to do for a very miserable creature, even after he is abandoned by his fellow soldiers.

"A poor soldier," says Paree, "in the train of the Marechal de Montjan, at Turin, was wounded near the wrist with a musket ball, and the arm fell into gangrene, the ball having lacerated the tendons and ligaments, and shattered many of the bones."

"The gangrene extended to the elbow, the mortification (or lesser degree of gangrene) extended to the shoulder, and that side of the breast was highly inflamed. He had hiccup, faintings, restlessness and other threatening symptoms of approaching death, so that he was abandoned by his surgeons; and his friends prevailed upon me to visit him in this condition. Seeing the mortification, I ventured, according to the rules of art, to cut off his arm at the elbow, tying it first firmly with a fillet, then cutting across the ligaments of the joint, then allowing the vessels to bleed, then securing them with cauteries, BECAUSE AT THAT TIME I KNEW NO BETTER PRACTICE: And then, undoing the fillet, I made several large and deep incisions into the gangrened arm, avoiding the inner side of the arm on account of the great artery and the numerous nerves, and then I cauterized several of the incisions, both to stop the hæmorrhagy, and to dry up and destroy the gangrenous and poisoned flesh."

"I supported him, and defended the heart from the poison carried to it along the arteries by cordials. But, on the 15th day, this poor man was taken with a strong convulsion, which I had foreseen, for it was extremely cold; and he was miserably laid in a granary, poorly covered, and exposed to every wind, without fire, wanting also all the other necessaries of life."

"The limbs were distorted, the mouth and face were also distorted and retracted, as in the *rifus fardonicus*. I was moved with pity, and extremely anxious to do my duty towards him. At such a time I could do nothing better for him than place him in a stable, amidst a great number of cattle, and lay him in warm dung. I then got some chaffing-dishes full of live coal, which I placed near him. I then had his legs, arms, and nape of the neck, rubbed with antispasmodic oils and balsams. I then wrapped him well up, placed him close by the burning chaffers, and there he lay without moving for three days, and three nights, during which time he had a slight diarrhœa, and

at the same time a heavy sweating. Then his mouth began to open, I helped it with the dilator for opening the locked jaw, and slipped in a little button of willow-tree to keep it open. He could now swallow, but of course could not chew; so I nourished him up with cows milk and eggs, and so cured him of the spasm. I finished the cure also by applying the burning irons from time to time to the bone; in which the patient delighted very much, for when the burning irons were applied, he said he felt a sort of titillation running along the bone; a circumstance which I have often observed in similar cases in the Hotel Dieu. The bone threw off great scales. Thus God and Nature instruct us to preserve our patient even when the mortal symptoms have come on. "Contingent in morbis monstrum sicut in natura *."

When a man enters upon such duties as these, he should be diligent, watchful, and laborious; humane, friendly, and self-denying; full of unceasing anxiety for others, and a noble disregard of himself. We will not define the chief qualities of a surgeon, in this cold-hearted way, of personal and showy accomplishments; mercy and tenderness towards his patients, and every kind of charity, are the chief virtues and most becoming ornaments of a surgeon. He must not be wearied out by the tediousness of his patient's sickness, nor provoked by the irritation of ill judging and officious friends. He must not show himself respectful and attentive to the rich only, nor careless of the poor because they are so. If sometimes an operation be required, let it be done rapidly where

* Another anecdote in Parez shows rather the rudeness of the times than the unavoidable horrors of war: The army was sadly pressed with hunger and want, so that he himself, with plenty of crowns in his purse, was for three days very near starving. A party had gone out to attack a church (where the peasants of the country had fortified themselves), hoping to get some booty of provisions, but they came back very soundly beaten; and one especially, a captain-lieutenant of the company of the Duke de Rohan, returned with seven gashes on his head, the least of which penetrated through both tables of the scull; besides four sabre wounds in the arm, and one across the shoulder which divided one half of the shoulder blade. When he was brought to quarters, his master the Duke judged him to be so desperately wounded that he absolutely proposed (as they were to march by day-light), to dig a ditch for him, and throw him into it, saying, "that it was as well that the peasants should finish him." But, being moved with pity, I told him, says Parez, "that the captain might yet be cured." Many gentlemen of the company joined with me in begging, that he might be allowed to go along with the baggage, since I was willing to dress and cure him. This was accordingly granted; I dressed him; put him into a small well-covered bed in a cart drawn by one horse. I was at once PHYSICIAN, SURGEON, APOTHECARY, and COOK to him. And thank God I did cure him in the end to the admiration of all the troops; and out of the first booty the MEN AT ARMS gave me a crown a-piece, and the ARCHERS half-a-crown each.

there is no danger ; but where there is any thing doubtful, let it be done slowly. If there be a tedious lingering disease, the surgeon must be every thing to his patient ; watchful, friendly, compassionate, cheerful ; for the patient lives upon his good looks ; it is when his surgeon becomes careless, or seems to forsake him, that he falls into despair. The surgeon must be especially careful of every thing that may conduce to his patient's comfort ; of supporting his strength, when it seems to flag, with wine and medicines, and of comforting him with anodynes and cordials when he sees him in pain. The surgeon must press out the matter cautiously from the deep fores, and draw the setons every day, with his own hand, to prevent new collections being formed and new fores. A shattered limb he will extend carefully on oil cloths ; and will wash it often himself, because cleanliness and comfort are of the first importance in preserving the health ; and well he knows how careless nurses and other attendants are. Indeed nothing can more encourage them in their duties, nor leave them so entirely without apology if they fail, as seeing from time to time the most unpleasant things done by the surgeon himself. The surgeon must be ready to propose consultations upon any appearance of danger. He must learn to submit with a good grace, when he is assailed with the forest of all affronts, the want of confidence in the patient himself, or the impertinence of friends. Such is the imbecility and weakness which attends on long confinement, that every one wishes at times for a change of men and measures ; and though conscious of the folly of what he desires, yet he cannot suppress that wish, which, being once indulged, his good sense and gratitude soon return.

These are among the chief duties of every surgeon, his daily occupations. But the duties of a military surgeon are such in the time of battle, that it is difficult to imagine how he has fortitude for such a scene. While others have things to do daring and spirited, suited to the time ; all his works require deliberation, judgment, and perfect composure ; he alone sits at a distance from the work of war, and all the hideous sights have their full effect upon his mind. And yet there are things still worse to bear than the natural, inevitable, horrors and hardships of service ; flights, losses, disappointments and unmerited neglect ! by those too, whom the surgeon has served, and who should be the natural guardians of his interests.

Mr. Aitken, in his *Navy Surgeon*, tells of a desperate wound which his captain had received in a battle at sea, and with how much difficulty he was able,

after cutting off his arm, to save his life. But, far from being rightly impressed by the sufferings of his captain, he breaks out into the following mean ungenerous expressions: "I watched over this gentleman, the Honourable Galfridus Walpole, brother to our minister of state, for two or three nights immediately succeeding the operation, though I had at that time forty wounded men to care for, supposing that tenderness and respect would ensure his good opinion, and consequently his interest. But notwithstanding all this, and all my future fatigue and extra work, he remained as calm and undisturbed as Burnet's devotée, never gave me a glass of wine or thanks for it (the reverse of his brother, loving cheap jobs). I must add, he suffered me to pay for him for making up Dr. Morton's prescriptions for him at Leghorn and Genoa, a proof of that thin and avaricious disposition which gave me so much trouble in his cure." Can any thing be more pitiful, ungenerous, unlike a gentleman than this is? Can any thing more degrade the profession, or disgrace the man? But I will refrain from any reflections on this, nor will I do you the disgrace to suppose you wanting in just offence, at seeing your profession thus dishonoured. It is enough that I hold this culprit up to your indignation and contempt. But if ever, in after life, you should at any time think yourselves injured or neglected, remember with what severe contempt you first heard of this manner of complaining. Respect yourselves, deserve well of your country, and all those who are around you will be sensible that you are deserving; refrain from complaints, which will but harden your enemies and disgust your friends.

DISCOURSE II.

HISTORY OF THE DOCTRINE OF ADHESION.

To pass at once from study to practice, from the mere reading of books to the most dangerous operations upon the living body, is an alarming step; it fills us with anxiety to think of it; and very seriously should we reflect upon the course of our studies; where one wrong step leads us into labyrinths of difficulties, and our time, our strength, and our patience, may be wasted in an unavailing struggle; even our love for our profession may yield to obstacles which are unexpected and unnatural.

Of all these difficulties, I know of none so discouraging to the eager spirit of a young man, as the too early attempt to procure a knowledge of practice. To be accomplished for practice is to have a mind stored with all kinds of knowledge; and a young man should gradually rise through all the dependencies of study; should pass through the history of his profession before he can be capable of understanding those conclusions which we call rules of practice. He must know whence those rules have arisen, why they have been changed, how they have been improved. He should know the period at which each interesting practice began, in what countries it has prevailed, and by what authors, and by what kind of reasoning, each rule in our general code is supported. For each rule is to be received with limitations and exceptions, with a degree of diffidence or confidence proportioned to the authorities and proofs which it brings along with it. To deliver rules, unqualified and absolute rules, into the hands of an untaught man, were to put a two-edged sword into the hands of an idiot.

Who is there so humble, as to be willing to practise an art which he does not understand, or to move according to rules which he cannot explain? rules which are not the result of his own particular knowledge, but the dogmas of others, the opinions of schools and writers whose works perhaps he knows not! of whose doctrines he is ignorant! whose practices he is to follow with a mean and slavish deference!

Rules of practice form the sum total of our knowledge, but they are not the means by which knowledge is to be acquired. They enter slowly into young minds, and have but a slender hold on an imagination unheated, unoccupied with the subject, unconscious of the slow and gradual changes, the silent but important revolutions by which science has been improved. The rules which I shall require you to learn shall be founded on histories, theories, and facts. You shall not follow with fervility the practice of myself or of any master; your opinions shall be your own, the result of your own particular knowledge. I know both how to respect the difficulties and uncertainties which you must feel when first entering on study, and how to lead you onwards to a general knowledge of your profession by slow and gradual steps; and as for the absolute rules of practice, I will not play the pedant over you, but give you a due share in forming them for yourselves.

You may depend upon it, that wherever there is a difference betwixt ancient and modern surgery, there is also a connection of infinite use to us if we could find it out; and it is by studying these connections that we are enabled to give a good account, not merely of the useless antiquities of surgery, but of the excellencies of modern practice: I have also observed, that where there exist any very singular prejudices connected with our profession, they have first arisen among the profession, though now perhaps they are to be found only among the vulgar and when there have been ill reports among the vulgar concerning the practices of medical men, they are seldom entirely void of truth.

In the treatment of wounds surgeons were at one time really very rude and cruel; they absolutely delayed the cure. They never allowed the lips of a wound to fall together, they filled it with dressings and acrid balsams, or distended it with tents and leaden tubes. They were ingenious in every invention to prevent its sudden healing. "The chief method of healing wounds, and the most respected," says Philiacutus, "is that called Canonico, in which there be four operations: The first is digestion; the second is mundification; the third is incarnation; and the fourth is cicatrization. Every wound was forced into a painful suppuration, which the surgeons of those days were careful to encourage in proportion as the wound seemed more inflamed. The quantity of matter was again an argument that the wound needed to be thoroughly purged of its foul humours. The pain of a wound and the waste of substance was very great, under their management, the cure was proportionably slow, the scar was broad and un-

lightly ; but they comforted themselves by saying, that this method alone was sure, and consistent with the rules of art. Those few surgeons who ventured upon the cure by direct and immediate adhesion, went fearfully and timidly to work. They were in continual apprehension of ill accidents ; and having failed to comply with the canonical or regular method, having neglected to purge the wound, the patient never suffered the slightest alteration of his health, even at the distance of years, which was not imputed, either from malice or ignorance, to this sudden and improvident cure. This was the real origin of the secret dressings ; and nothing can be more singular than the various inventions which surgeons, in those days, fell upon, to persuade their patients to let their wounds be easily healed, and, at the same time, protect themselves from blame. Indeed, when we consider the continual protestations made by La Motte and other good surgeons of their never having, for the sake of gain, used any tents or injections to protract a cure, we cannot banish from our minds some very unpleasant reflections. For while these authors enter their protest against the general conduct of other surgeons, and show their anxiety to proclaim their own innocence, we cannot but see that they point at some practices and motives of conduct which we fain would not believe. In those days, every flap of skin, instead of being reunited, was cut away ; every open wound was dressed as a sore, and every deep one was plugged up with a tent, lest it should heal. Tents, syndons, setons, leaden canulas, and strong injections, were among the chief violences of ancient surgery. And no man wishing to treat his patient MORE CANONICO, or by that rule which alone could vindicate him to the profession, no man, I say, who regarded his own character, went without this cruel apparatus of tents and syndons when he was to dress even a slight wound. The old surgeons never put the lips of any wound together ; if it was not large and free, their rule was to dilate it, but never with the knife ; with a sort of forceps they tore it open ; they seldom made counter openings to let out the matter ; they never sought to put an end to the formation of pus, and the waste of the fleshy parts, but encouraged the suppurations. They plugged up the orifice in order to dilate it. They made their tents long that they might convey acrid medicines to the very bottom of the wound. They forced the suppuration in order to prepare it for the second stage of their process, viz. incarnation. They prevented the natural and easy flow of the matter that they might have the satisfaction of seeing it spout out in great profusion when they withdrew their tent. They opposed their own

ways always to those of nature, and liked nothing which was not done by main force of surgery. This is what I mean when I speak of their coarse and cruel practice; tents, syndons, setons, leaden canulas, may all be used with advantage; but I am now observing only how they were abused; for no wound escaped this violence; and the practice of an ancient surgeon was exactly the same with that by which beggars counterfeit sores, or rather convert accidental wounds into perpetual ulcers. The most simple wounds of the limbs were frequently tortured by the old surgeons into the form of malignant sores, running for many months; wounds of the great cavities were always distended with tents to the imminent danger of the patient; if he survived, there remained fistulas which would never heal; the sores ran more or less according to his state of health, or the season of the year; and a man wounded in the chest wore his leaden canula for life. "But that which surprises me most of all," says an old author, "is to find the afflicted persons brook the inconveniences they suffer with a sort of satisfaction."

The old surgeons thrust their tents into all wounds, both those which were in danger of healing and those also which could not heal. They thrust them into gun-shot wounds, of which, if they had understood the nature, they could have been under no apprehension of their healing suddenly, since the whole course of a gun-shot wound is mortified, and the parts through which the ball has passed being effectually killed, must be thrown off in sloughs. They thrust their long tents into the neck, or even into wounds of the cheek, till the neck or head swelled monstrously. Even in compound fractures, they thrust them deep betwixt the ends of the broken bones, as if they had been afraid lest a callus should form. They introduced their tents even into the cavities of the belly and breast. They never trepanned the skull where there was inward suppuration, without thrusting a tent into the substance of the brain itself, though sometimes they were contented with laying in a syndon, or slip of linen. We cannot wonder that these things were done by ordinary surgeons, men of low education, mere curers of wounds, who dared not to think for themselves, nor act otherwise than according to the strict rules of surgery; but what must be our surprise upon finding an author like Vesalius writing in the following manner: "*Modus autem five formaturundarum equalis ex linamentis debet, ex aliis vero materiis in modum Claviculi Lignei quem latini impagem vocant* *." This amounts nearly to the description

* Chirurgia Mag. p. 1002.

given by La Motte, of ignorant surgeons making tents as hard, and as long, as the firmness of the materials, or the deepness of the wound, would allow; twisting and thrusting them in with the fingers and thumb. "Often I am sure," says La Motte, "I have seen those who would have been very willing to have taken the help of a mallet to drive in their tents into the thorax. It was from shame only that they refrained." In my young days, says Belloste, when I frequented hospitals, and practised with very able surgeons, I have seen, at the time of the dressing, the tents for the most part expelled from the wounds in spite of the bolster and bandage."

In France those practices were carried to more extravagant lengths, in proportion as our profession was in that country in lower repute, and its professors less perfectly instructed. Belloste was the first reformer who arose in that country; and I refer you to his book for some very extraordinary facts. In one soldier, who was wounded quite across the belly by a ball, which entered near the navel, and passed out through the kidney, he found that the wound inflicted by the ball at entering, had healed in spite of all the surgeon's diligence; but the posterior orifice where the kidney was injured, the surgeon had contrived to keep open with a very long and hard tent, which he had thrust even into the substance of the kidney, occasioning a perpetual flow of urine from the part. This fistula Belloste cured by drawing out the tent, eating away the callous edges of the sore with caustic, pressing its lips together, and injecting occasionally some vulnerary water.

Even the joints were not spared. In the same war, Mr. Belloste attended an officer who had been wounded in the knee, and had been dressed by his own surgeon, skillfully enough, according to the fashion of those times. But, fortunately, at the end of four months, his own surgeon was obliged to go away; and Mr. Belloste was called in, and found in the knee six fistulous holes, each hole spiked up with a hard tent, and each tent long enough to reach to the bottom of the joint. The leg and foot were exceedingly swelled, and the body proportionably emaciated. The patient had a hectic fever, perpetual watchfulness, insufferable pain, and a loathing of all kinds of food. The whole joint was surrounded with matter, the gutter leading backwards from each fistulous sore communicated with some adjoining hole, and the dressers had every morning stopped up the rest of the openings with their fingers, while they injected, by some one hole, a spirituous tincture, which distended the whole knee with

intolerable pain. The first night of sound sleep which the patient had enjoyed from the day of his wound, was that in which Mr. Belloste dressed him in an easy way ; and such was the impression this relief made upon him, that in the morning, amidst all his friends, he embraced Mr. Belloste as one who had saved his life : and indeed he was entirely recovered in a month.

France was the school in which all our old surgeons were taught their profession : and we find, from the book of Colbatch, (a man who volunteered in our armies in Flanders in a very extraordinary manner), that in this country the same rude and cruel practices prevailed. Among his cures, is one of a poor foldier “ who was wounded with one musket ball which entered at the corner of his right eye, and passing through the os spongiosum, or spongy bone of the nose, came out at the left eye, tearing that eye all to pieces ; while another bullet, entering at the same orifice, passed through the upper mandible, or jaw bone, and came out at the corner of the under jaw. Those two wounds were crammed as full as they could hold with hard dossils dipped in spirits of wine, which I ordered, says Colbatch, to be pulled out ; and although this was done with the greatest difficulty, and put the poor creature to most intolerable pain, yet his bravery and undauntedness of spirit were such, that he never even smayed at it all the time it was doing. The surgeon had, as he said, pulled out all the dossils, and dressed the wounds with my powder ; but our injections, though they passed through the one bullet wound, would not pass through the other ; wherefore I concluded there must be still some dossils behind ; but the wound being very deep, we could not come at ever a one with the forceps. The poor man’s head and face were swelled to such a degree, that he looked like a monster. But about the twelfth day after, while the army was on their march, and he along with them, Mr. Cholmondely having taken off the dressings to apply fresh ones, a dossil of the thickness of a man’s thumb came out, and in a little time his wounds were all cured *.” “ In those days, nothing was to be heard in the hospitals at the time of dressing but howlings and cries.” “ There are some surgeons, says Belloste, who do not think they have acquitted themselves as they ought, unless they have made those under their hands roar out, which makes some people to judge that SURGERY and CRUELTY are INSEPARABLE †.” In those days the tenting of a wound was the whole surgery of a wound, without which it was imagined to be impossible for it

* Vid. Colbatch’s Tracts.

† Vid. the Hospital Surgeon, p. 35.

to heal. Our great poet had no curse more dreadful to put into the mouth of the old king than this, "Th' untented woundings of a father's curse pierce every sense about thee *."

Among those who wrote against this rude and violent practice, I might number all the oldest and most respectable surgeons. But although Paree says, God knows the pleasure and profit too I have enjoyed from using tents more sparingly †, no one was bold enough openly to declare his intention of joining the lips of a wound by direct adhesion. A man proposing such romantic doctrines, directly and openly, would have been held in high contempt by the learned; but if he was bold and cunning enough to give an air of incantation to his cures, or to declare that they were performed by a secret philosophical sympathy known to himself only, or to other very learned men, then he was sure of rousing at least one half of the learned world to combat in his cause. We find indeed no one sympathetic cure which is not performed plainly by procuring a speedy agglutination of the wound; nor one surgeon in Europe who ventured to unite wounds directly by adhesion, without pretending to have learnt from some eastern sage, or to have found out by deep studies in philosophy and alchemy, a sympathetic, or, as they often called it, a philosophical cure of wounds.

The first inventor of the sympathetic powder was the celebrated Paracelsus; and the first who published this secret to the world was one Ericcius Mohyus of Eburo, who put forth a little book; "but in that book, says Van Helmont, he hath neglected the detective faculty or virtue which may bring the virtue of the sympathetic powder, received in the bloody towel, into the distant wound ‡."

* Dr. Jackson of Exeter has taken up the trade of the black letter dogs; and in his criticism on this passage tells us, that it should be written as it was heretofore, Th' untender woundings of a father's curse; that it is printed so in the old editions very plainly; and that it would be waste of time to show the propriety of this. "There is no such word," says Dr. Jackson, "as untented." Now, to tell us that curses are untender; that a father's curses are untender; and that the curses of a father, poured out in the agony and bitterness of his soul, are untender, is rather superfluous. But the irremediable woundings of a father's curse, a wound so deep that no surgery can cure it, is something. To say untented, is as natural as to say unanointed, unanealed.

† Page 209.

‡ This much celebrated author Van Helmont, he who with great benignity dedicates his book to God Almighty, is the panegyrist of Paracelsus, and his methods of cure. His dedication begins, Omnipotent, Eternal, Incomprehensible Being. And concludes, So, O Lord! I cast down this poor dedication before thy most mighty throne; and do thou, O my Intercessor, offer up this my work to the Holy Trinity, where-

The Paracelsian doctors flourished in England when Dr. Charleton wrote his Ternary of Paradoxes, chiefly on the magnetic or attractive power of wounds; and this fanaticism, which lasted for no short time, is not perhaps to be paralleled in those ages when all Europe was absorbed in the study of the perpetual elixir, the universal solvent, and the transmutation of base metals into gold. This fanaticism relates to your profession, and therefore I will give you a history of it in few words:—

Sir Kenelm Digby, secretary to Charles the First, was driven into exile during the civil wars; and in that period of his life we find him at Montpellier pronouncing among the doctors there a public oration, in which he congratulates the world upon the discovery of this sympathetic powder, which he had first learnt from a Carmelite, who had travelled over Persia, India, and China. Soon after this oration, Digby returned home; and in no country was there a fairer opportunity of exhibition than in England, where even the Court was infected with this mental disease; the King himself writing on Demonology; courts of justice condemning witches to the stake, and a nobility running from one end of the kingdom to the other to have their horoscopes read to them.

“One morning,” says Digby, “came to me Mr. James Howell secretary to the Duke of Buckingham, who, rushing in between two friends in a rencounter, had been grievously wounded in the palm of the hand, through the tendons, nerves, and muscles. I desired to have the cloth, or any thing which was but stained with his blood. A bloody garter was brought to me. I dissolved a handful of vitriol, and threw into it the garter just as it was brought, when presently the Secretary, who was talking with some noblemen in a corner of the

unto I dedicate it, so act thou for the glory of God. He protests that his chief motive for the dedication is to “avow the feud or free farm of his essence to God; and he seems to be very sorrowful and melancholy at not being able to get a translation of the Hallelujah, which the angels are continually singing, for it would make a very fine part of the dedication. Van Helmont not only delivered the learned sympathetic experiments of his master Paracelsus, but added many of his own; and especially you will find in p. 704, how he held the fore-paw of a lady’s lap dog in his hand with a certain herb, by which the lap dog was so persuaded, that it forsook the lady its mistress, and stood and howled for love of Van Helmont all night at his chamber door.

There you will find also love powders and potions, and their effects; and how a certain gentleman having borrowed a nose from the backside of a silk weaver in Bologna, the surreptitious nose one day looked very blue, and next day dropped off; and when he sent express to Bologna to know what was the matter, he found that the weaver had fallen sick and died on the very day on which the nose became blue, and that the backside could not well have been cold before the “sympathetic snout dropped off.”

chamber, and quite ignorant of what was doing, found himself suddenly relieved from all pain, and felt very strangely at the same time, as if all at once a cold breath had blown upon his hand, or as if a moist cloth had been laid over the back of it. While the Secretary took care of the hand to keep it clean, and in good condition, I (says Digby) kept the BASIN carefully in the sun by day, and in a warm corner of a stove by night; so that the garter never wanted that degree of heat which is natural and kindly to the living body*. This affair of the Secretary came to the ear of the Duke, and through him to the King, who became very desirous of knowing the truth of such an affair; and Digby, the more to incite the King and the Duke, went immediately after dinner, and took out the garter from the basin, and began to roast it before a brisk fire. But before it was half dry, a servant maid came running breathless to tell him, that her master had been just then seized with a more dreadful pain than he had ever had, and with a sense of burning, as if live coals had been laid upon his hand. Digby told her, that he suspected, nay he absolutely knew the reason, and that he should take care that her master should be immediately relieved; so having plumped the garter into the basin again! before the girl got round to the next house where her master lived he was quite relieved from pain, and was soon cured.

If these philosophical physicians had not been all very serious about this sympathetic cure of wounds, one should naturally have suspected the learned letter of the Clarissimus Dom. Straufs, to be a piece of finished irony. "That very cure," says he in his letter to Digby, "which you performed upon the Secretary Howell, was performed by an English nobleman, L. Nicholas Gilbourne, upon a carpenter; but he performed it in the dry way. This nobleman, Gilbourne, always kept a box of the sympathetic ointment by him. He heard that a certain carpenter had cut himself very deep with his axe. He sent for the axe, which was all bespattered with blood, and smearing the edge of the axe with his ointment, he wrapped it up warmly and carefully with linen, and hanging it up upon a nail in his closet, locked the door and left it there†. From this time the carpenter found himself perfectly relieved, and mended daily to his

* Ita ut sanguis pericellide adherens, nunquam non in loco naturali, corporis sani temperamento conveniente, asseveratur. So that the garter was all the while at the bottom of the basin minding its business, while the Secretary was going about his own concerns.

† Unguento suo securis aciem cruentam perficans eamque pannis linteis a frigore muniens.

heart's content. But one day he complained very greatly of his wound, and of the heat and pain in it; and his friends wondering what it could arise from, since they saw no outward cause for this sudden pain, ran to the Lord Gilbourne, who stepped into his study with all possible haste, and found, to his utter confusion, that the axe by some unlucky accident had fallen down from the nail; it was lying upon the ground uncovered, all the kindly cloths which he had wrapped about it fallen off, and the anointed part quite exposed *.

These were the cures known by the name of Sympathetic, because performed at a distance, and by the medium of a bloody towel, or by practising upon the bloody stain which was left upon the sword or knife. In want of the guilty knife, they drew any other knife or sword across the wound, and stained it with blood, and operated upon it. The medicines which they used they called sympathetic powders, sympathetic solutions, or the unguentum armarium, because the ointment was applied to the weapon †.

I shall not detain you with their manner of preparing their vitriol for three hundred and sixty-five hours under the sun, while the sun passed through certain signs of the zodiac; nor with their manner of compounding their ointments, which were made of materials more heterogeneous and horrid than those which the witches drop into the cauldron; human fat! human blood! mummy, the moss that grows in dead men's skulls, a hog's brains, &c. You have a perfect conception of the Gothic ignorance and wild fanaticism of the times, when I tell you,

* *Ad suum conclavum, festino gradu properat; invenitque securim, forte fortunâ humo prostratum, linteis amiculis destitutum atque partem unctam aeris inclementiæ obnoxiam.* There is no want of authorities for cures of this kind. Mohyus cured the celebrated Italian Captain Doria of a cruel fistula in his ham by sympathy. All wounds were cured by bloody napkins, and all ulcers by napkins moistened in the pus or serum. Octavius Guaseus cured all his wounded soldiers in this way, which must have been a vastly convenient thing for a General; especially as this sympathy is an influence which some of the sympathetic doctors affirmed might cure a man though he were in the moon, just as easily as the moon causes tides in the sea; and all of them were ready to affirm, that the sympathy extended thousands of miles. "*Asperfo pulvere vel loco vicino, vel quantum vis remoto patiente, seu sine ullo loci termino. Multo magis esse sphaera aliorum agentium sublunarium ab 1000 milliaria propagari haud temere assero.*" The celebrated Papin, who invented the Digester, after enumerating many cures, takes a witness very suitable to the occasion. *Testem voco occultissime Cassanie, qui ejusmodi stupenda toties observasti.* Is not this an admirable invocation and most apt epithet. *Occulatissimus Cassaneus?*

† "If it be a punctured wound merely, take your unguentum armarium and draw it along the sword from the point towards the hilt; if it be a deep cut, lay on the ointment by stroking from the side towards the back of the weapon; if you be not sure how deep the wound is, anoint the sword or knife all over."

that among the great masters of the sympathetic school, one of the chief schisms arose from this question, "Whether it was necessary that the moss should grow absolutely in the scull of a thief who had hung on the gallows, and whether the ointment, while compounding, was to be stirred with a murderer's knife?" Such was the ignorance of that age, that those who opposed these sympathetic cures never questioned the fact. Even Hildanus acknowledges, that the sympathetic physicians treated wounds, or rather the knives which made the wounds, "*quotidie, et quidem ut par est, diligenter; cito, et ut videbatur, satis feliciter et fere absque dolore.*" This is not ironically, but very seriously said. "Yet often," says Hildanus, "this method produces inflammation, makes the wound run with foul sanies; and, worse than all, it ruins both soul and body; it leaves a black indelible stain in the conscience of him who uses it; for it is an invention of the very devil himself*."

Even in Protestant countries, such as Hildanus and Digby lived in, it was not altogether safe to incur the reproach of performing incantations. We may be sure there was some danger, from the violence with which the enemies of the sympathetic cures exclaimed. *O hominis inaudita impietas O fæva inhumanitas!* The professors, therefore, of the sympathetic cures began to protest that they used no incantations; and they defended their cures on philosophical principles, by the analogy of other natural operations. The celebrated Des Cartes, Kircher, Gilbertus, Papin, Charleton, and a hundred others, produced philosophical proofs, very suitable to the grotesque taste of those times†. But, like other jugglers, they did not neglect the means of escape. Digby, who was the master spirit of them all, first showed by how many philosophical analogies the sympathetic cure was supported, and then proceeded to remark, that the vital spirit of the blood sinks into the stuff of the linen, or into the metallic pores of

* "*Non solum gravissima symptomata excitat, optimamque valitudinem, corporis destruit, conscientie quietiam maculam inurit. Inventorem hujus unguenti esse Biabolum testantur viri doctissimi.*" Hild. p. 851. In officino vero Diaboli, unguentum hoc pestiferum nocumentum non medicamentum, &c. Experientiam non negamus nequaquam vi naturæ sed Cacodemonis consilio, &c. Deusingius, p. 41. Papin passim.

† Their arguments were generally such as follow: That any lute being tuned in unison with another, is affected when the other is struck; the magnet turns by sympathy to the pole; amber attracts light bodies; the lapis ætites hung round any part of a woman in labour, attracts the foetus, delays the labour when hung round the neck, and quickens it when hung round the thigh, and when laid on the pit of the stomach, comforts the child. Loadstones hung to the breast make us cheerful and merry, and the WEARING of JEWELS secures CHASTITY!!! *Adamantim cordi lætitiæ conciliare, Saphirum Smaragdum, Uniones castitatem; non est contra rationem.* If it be not against reason, it is, however, a little against experience,

the sword ; for this subtil spirit penetrates the pores and resides among them ; but if this spirit, says Digby, be evaporated by time, or drowned by moisture, or washed out of the linen, especially by hot water, vinegar, or soap (for cold water signifies less), or if it be burnt out of the sword by heating it, then all is over, for the spirit being gone, what good can the vitriol do upon the sword or linen ? To be assured of this, you have but to expose the sword-blade to heat. “ You will see,” says Digby, “ the very spirit itself sweating out upon the opposite side like breath upon a looking-glass.”

We can represent to ourselves one of those juggling philosophers, poring with glasses over the knife or sword, learning from the bearer of it, all the circumstances of the wound ; first, discovering whether the wound be such as will prove too hard for the sympathetic cure, and then telling the bearer with a grave face, that he perceives that all the finer spirits are escaped !

At first we are surpris'd with the universal approbation which these follies met with from all the great men of those times. They all acknowledge that sympathetic cures were successful. They refused to practise these cures, only because they were impious and unlawful ; for even Hildanus and Purmannus say, “ though many have written against this, how can we contradict matters of fact.” The matter of fact is easily explained. These sympathetic physicians understood the cure of wounds by adhesion, more perfectly than the other physicians of their time. The world needed to be cheated into this safe and easy method of cure. They used their sympathetic cure (which was plainly a way of procuring adhesion) in no cases which might bring disgrace upon their art ; they refused to use it in wounds where they could foresee suppuration ; they declined it “ where much digestion was required, or where the larger blood vessels were wounded.” They absolutely refused to perform their sympathetics in cases of gunshot wounds *. They took care to pledge themselves only for those wounds which they were sure might be made to adhere. Purmannus himself saw a quack in the city of

that diamonds and pearls should secure chastity. Papin saw a magnet hung about a fig-tree which ripened the fruit before his eyes, and when the magnet was laid at the root of the tree, down came the figs in showers. In less than ten hours the whole tree was unloaded ; but only he forgets to mention whether the experiment will succeed in calm weather. *Huic enim (ficui, viz.) submisso lapide, omnes sponte grossuli minus horis decem deorsum ceciderunt.*

* Senertus in his *Liber Practica*, 5 p. 4. c. 10, observes, especially in speaking of the unguentum armarium, that even among those who had praised it the most, no one ever ventured to use it in GUNSHOT WOUNDS, though he himself could produce some very singular incontestible proofs of its success.

Glogow mount the stage, and in presence of the people, make thirteen gashes in the fleshy part of his own arm, and roll it up very tight, closing first the wounds with slips of linen dipped in some warm mixture. According to his promise, he produced it next day to the people as good as healed. "This proves, says Purmannus, that this man knew how to cure wounds in a day's time, without the tedious method of bringing them to suppuration; a young surgeon who lived in my house, bought this secret from him for six rix dollars; it was merely a plaster made of gum and mucilage; so that this may be truly called gluing wounds together *.

In those days then, the curing of a wound by adhesion, was a thing which gave reputation even to a mountebank, and seemed indeed miraculous. But the sympathetic doctors knew the secret, and how to make their own use of it. They chose out fit cases of clean incised wounds, they put the lips neatly together, and very generally held them close by a sticking plaster, so well composed and so firm, that they called it the *Emplastrum Strictivum* †, they took care never to undo the dressing till the wound was healed. Had they openly professed to heal a wound of the scalp without exfoliating the bone, or a wound of the flesh, without a due purging off of the foul humours; had they proposed to lay the lips of a wound simply together and make them adhere, they would have been greatly abused for following the simple rules of nature. But they contrived to get credit for something like witchcraft, and they condescended to dress the axes and swords that the wounds themselves might have leave to lie at rest till they healed. I will add to these, a short history of one of our own physicians, above the rank, but not above the practices of a quack. It will prove how very slowly the best methods were received, and how perfectly this practice of procuring immediate adhesion had succeeded, even in the most dangerous wounds and in the rudest hands.

The person I mean was named Dr. Colbatch, whose history, according to my understanding of it, is exactly that of a respectable quack. Dr. Colbatch began his career by proclaiming to the world, "That he had, after seven years.

* When carpenters wound themselves with their tools, they take a thin wood shaving, and spreading it with hot glue, they glue together the lips of the wound; the shaving sticks fast till the wound adheres and soon falls off of its own accord.

† These very powerful adhesive plasters were very generally composed of gums, wax, strong glue, and sometimes white of eggs, and the composition, something betwixt a paste and a plaster, was made so firm that nothing could displace it till the wound adhered.

spent in experiments and study, lighted upon a pair of medicines which were infallible in the cure of wounds; the one an internal medicine, the other external." Finding that these would answer, he began to make his experiments upon dogs, by wounding them in the most desperate ways. Of one hundred experiments, five only failed, three of these were made before my Lord Cutts. "Two of these dogs," says Colbatch, "as I can plainly make it appear, were poisoned after the chief danger of the experiment was over. His enemies among the camp surgeons were so wicked as to poison even his patients like dogs. I was much abused, says Colbatch, in the case of a soldier of Lord Cutts's regiment; for after my medicines had relieved him of almost all ill symptoms, and I had been myself constantly with him during four or five nights for fear of mischief, he was, in my absence, made drunk, and died an hour or two after my return." At his own cost, Dr. Colbatch had bought and prepared a great quantity of his pair of medicines, and went over at his own charges to Flanders, where it appears that the King had taken very particular notice of him, ordering by public proclamation in the camp, that the wounded should be brought to him. It is to be noticed, that in all the methods of secret dressing, there has been a strange mixture of quackery and incantation; and whether the cure was performed by sympathetic powers, or unguentum armarium, or by sucking; the reports of its success were always very extravagant; the reports and cases of Dr. Colbatch are by no means over modest. His cases are very extravagant in the manner and circumstances, but in all the essentials, I believe, they are very true. We are to judge from his general principles, not from his particular facts; or, in other words, we must make large allowance for the manners of those times. We dare not, for example, trust entirely to his reports concerning the army surgeons, for it was his business to find out reproaches against them; but there are many things which show him to have been a man of observation, one who understood the radical errors of their practice. I observe, says he, first, "That in all wounds of any consequence, though merely flesh wounds, &c. they confine their patients to the lowest diet imaginable, forbidding them flesh and wine, and that although they have suffered great loss of blood." Secondly, he says, "I will not mention the tenting, probing, and other trumpery and nonsense which are used by most surgeons to the great detriment of their patients." His method, so far as he allows himself to disclose it, is manifestly one which must have been of infinite importance in

an army, where all the surgeons tortured their patients MORE CANONICO, and where he alone cured wounds by adhesion. He explains himself thus: "Suppose a wound to be made with a sword, or other cutting instrument, the length or depth of which signifies nothing, I dissolve some quantity of my powder in water; I wash and squeeze the wound, and inject a little of this said water into it; I then close its edges together, and, if wide and large, I STITCH IT UP. In all cases where my medicines have been applied in good time, especially in all incised wounds, the wounds are perfectly cured in a FEW DAYS WITHOUT BEING BROUGHT TO SUPPURATION, and I have frequently observed, that at about four days end, such wounds have been filled with a substance like unto hartshorn jelly, which I have conjectured to be the new flesh." When we see the man proceeding on such certain principles, we are sure that he must have been of infinite use; and being the only man in the camp who knew how to cure a wound by adhesion, his cures must have been very surprising, and his patients particularly easy, while those of others were enduring great pain. To be assured of this, we need only know his principle, and we must not undervalue his skill on account of the lying exaggerations with which he thinks fit to set it off. I am persuaded that he often cured, without any bad symptom, men who were thrust through the breast or belly, and yet I am amused with his manner of telling it. In wounds of the breast he never fails to settle the point of the lungs being actually wounded, by telling us how great the blast of air was. In most of his cases "the blast is almost equal to that of an ordinary pair of bellows." In one case it blew a perfect hurricane; for Mr. Cholmondely, his assistant, declared that he could scarcely with his hand keep on a dressing, so that in order to bring the lips of the wound together, he took a needle and thread and sewed up the wound, but the force of the air was so great, that he was forced to make his stitches in the external part of the bone (i. e. of the rib) which is gristly, by reason that the skin was not strong enough to hold them."

Another of those who followed our armies two centuries ago, is that famous physician and knight, Fiorovant. He protests much against the irregular method of digesting, and incarning of wounds, the stuffing them, teasing them with all kinds of washes and ointments, and parching them with turpentine and hot oils. "Dress your wounds," says Fiorovant, "in whatever parts of the body, without any tenting at all; for the third order of cure is of our own invention, that is, wheresoever a man hath a wound, either simple or compound, the first thing that is to be done therein, is to join the parts close together, and

to stitch them and dress them with various sorts of drying medicines." As to simple wounds, where no sinew, bone or vein is injured, join the wound together quickly, and stitch it close, AS THEY USE TO SEW BAGS, and not with great wide stitches. To heal wounds according to the manner of the ancients, it were great trouble to the surgeon, and pity to see the pain of the patient. Now, since this Fiorovant was at such pains in putting the lips of the wound together, we need not wonder that his balsam, BALSAMUM FIOROVANTI, had come into such repute, nor need we trouble ourselves to inquire what it was. Still this most excellent practice of procuring adhesion, was avowed by no one; and while the regular surgical method of suppurating and digesting, and incarning and cicatrizing of wounds, was alone acknowledged by men of learning, this better practice of procuring adhesion, continued almost exclusively in the hands of quacks.

Though all these cures by adhesion were very mysteriously performed, yet one in particular was called the SECRET DRESSING, in which great pains were taken, before laying the lips of the wound together, to suck out all the blood. The cure of wounds by SUCKING, was called the secret dressing; it was chiefly used in the army; the drummers of the regiment were the suckers; and the common soldiers submitted to this cure secretly, in order to conceal their quarrels from their officers and from the priests. The practice of duelling had proceeded to such lengths in France, that even the common soldiers settled their drunken quarrels with the sword. A hasty word betwixt soldiers of two regiments in garrison, established a perpetual quarrel betwixt the corps. They went out in the evening to the skirts of some adjoining wood, and fought by scores; when they happened to quarrel in taverns, they fixed their pocket-knives upon the brooms and mop-sticks; and when their knives and side-arms were taken from them, they fought with sticks sharpened and hardened in the fire, which we find made more desperate wounds than tempered swords; wounds, bruised, livid, and floughing, like those made by shot. When a party went out to the wood, the drummer of the regiment, or some good experienced sucker, went along with them. The duel ended the moment that one of the combatants received a wound; the sucker immediately applied himself to suck the wound, and continued sucking and discharging the blood, till the wound ceased to bleed, and then, the wound being clean, he applied a piece of chewed paper upon the mouth of it, tied up the limb with a tight bandage, and the patient walked home. The *savoir-faire*, or trick and cunning of this way of cure, consisted in making

grimaces and contortions, signing their patient with the sign of the cross, and muttering between their teeth some unintelligible jargon. All their care was to keep their profession among themselves; and it was from this profanation of the name of Christ, and this abuse of the sign of his cross, that there arose a hot war betwixt the priests and the suckers, the priests refusing confession, extreme unction, or any sacrament of the church, to those who had undergone these magical or diabolical ceremonies;—while the suckers, on the other hand, refused to suck those who had any connection with the priests. The former were afraid of losing the dues of the church, and the privilege of giving extreme unction and dismissing the soul to heaven (for those who submitted to the secret dressing were usually past all relief before the secret was disclosed to the priests): the latter, on their parts, were careful to preserve a trade which was not without its emoluments. Verduc observes, “*Suxerunt quidem at non sanguinem sed potius aurum.*” They were still more skilful in sucking gold than blood*.

In flesh wounds they could not fail of perfect success. The sucking out the blood, the cleaning the wound, the laying on of compresses, and the close and nice bandages which they applied, prevented the further effusion of blood (which always acts as a foreign body, and prevents adhesion), and secured to them a very speedy cure. No wonder, then, that this became a universal practice, and that men of high rank carried suckers with them when they went to fight duels. The success of the secret dressing was acknowledged by the most eminent surgeons. “I could well believe, says La Motte, speaking of the suckers, that they often healed flesh wounds, of the arm, for example; but that they should heal wounds across the cavities of the breast and belly in a few days, and altogether conceal the wound, seemed quite incredible.” Yet this was true, and this fact may be a comfortable assurance to us, that even among

* This business of sucking had been the basest trade of all. “Two gentlemen having gone out in an affair of honour, one of them was wounded through the breast, about a finger’s breadth beneath the right nipple. There was a wound of the intercostal artery, with great oppression of breathing; there was also a spitting of blood, which signified that the lungs were not unhurt. He was carried into his inn in a state of delirium, where every thing that was necessary was done for him. But before he was dressed, there was a great clamour among the crowd about some who could suck out the blood that was in the chest. Upon being brought in to suck the wound, one of the rogues, while sucking, stole a diamond ring from the gentleman’s finger worth a thousand florins, and was taken in the fact.” *Unus enim inter sugendum, vulnerato annullum adamantinum, mille florentis comparatum clam detraxit sed proditus iterum restituit.*

the viscera we may procure adhesion of the various wounded parts. For La Motte himself was incredulous; he had the faithful testimony of those secret combatants; he had often seen the scars, both on the back and on the breast, of wounds which must have passed quite through the bowels and lungs! but still he would not believe, until at last he had the good fortune to see this magical piece of surgery performed with perfect success.

“One day he was called to a young fellow, a common soldier, who had been run through the breast with a fair lounge, in at the pap and out at the shoulder. After having examined the wound, and noticed, says La Motte, the length of his antagonist’s sword, being well satisfied that the weapon had pierced the lungs, and gone quite across the breast, I saw the drummer of the regiment (who was the sucker on this occasion), do his business. He first sucked one wound; then, turning his patient over, he sucked next the opposite wound; he then applied a piece of chewed paper upon each, and next day the soldier was seen walking in the streets.” After this La Motte saw a man of better condition sucked with the same success. He was the brigadier of a horse regiment, who had been wounded quite across the lungs, but without any material harm to the lungs, or great vessels. Thus, says La Motte, is this way of sucking wonderfully successful; and with great ingeniousness, he adds, “Indeed, it appears to me, that if these suckers applied their cure with ordinary discretion, sucking no wounds but such as could be cured by adhesion, their method would be more successful than any that we surgeons use*.”

In duels with the sword, the wound is often in the thorax, and usually through the lungs; it is never a simple wound, and yet it will often heal; sometimes some great artery is wounded; the intercostal artery, perhaps, is touched, and pours out blood, the chest is filled with the blood, and the patient falls into oppressions and anxieties. Even in this complicated case, the suckers sometimes succeeded so far as to heal the outward wound; but the patient being oppressed by the inward bleeding, was, in a few days, in danger of suffocation, and often became unable to speak, had fallen into deadly faints, and was receiving the last sacrament of extreme unction before a regular surgeon was called to lay open the wound, and discharge the blood. Dionis had been troubled in his time with the suckers; and in a quarrel which happened in one of the courts of the palace of Versailles, two gentlemen of high rank

* La Motte, p. 22.

were both at once wounded in the breast; one was sucked by the drummer of his own regiment, the other was committed to the care of Dionis; and next morning it was wickedly reported to the King, that the gentleman committed to the care of Dionis was dead, while he who was sucked, was out of danger. This might have happened, and might have done harm a thousand ways! but so it chanced, that the truth was directly the contrary to this first report; for, in the evening, this latter gentleman was seized with such oppression, that he had taken the last sacrament before Dionis could be brought to him. When he came, he performed the operation for empyema, opened the chest, let out the extravasated blood which oppressed him, so as to relieve him instantly, and cure him in a very short while. Both the patients were thus saved by Dionis.

It seems as if from the first a sort of fatality had hung over the doctrine of adhesion, which was, however, in the end, destined to improve surgery more than any other; for the practice of procuring adhesion had been a profession only among quacks; nor did they even dare to declare an intention of immediately reuniting wounds in direct opposition to the canons of surgery. This practice had never been received by men of learning, nor risen into the importance of a doctrine; but it was about to do so, when most unhappily for our profession, Talicotius published it as an invention of his own! but in a form so fantastic, and connected with such idle and trivial objects, that it became with all the learned, as well as among medical men, a matter of amusement; and the world was justified in their contempt and ridicule of it by the opinions of the greatest men in our science. "Neither art nor nature, says Vesallius, is endowed with such powers as to restore a nose which has been cut off; to attempt such a cure is little better than if an ape should begin to philosophize, and say, I will go and learn to fly *." This was unfortunately the light in which all sensible men considered a doctrine which, had it been received a hundred years ago, as it is at this day, would have saved the lives of thousands. But most unhappily, after the days of witchcraft, and sympathetic cures, were over, there rose up several doctrines too similar to them to be well received; the extravagance of the discoverers took away all hopes of profiting by their inventions; surgeons turned

* "Atque proinde ejusmodi curationem tentare idem est ac si simia philosopharetur velletque per aerem volare." Vesallius, 983. Is it not very extraordinary that this very author Vesallius should be quoted by Portal, in his History of Surgery and Anatomy, as a strong supporter of Talicotius's doctrines?

with contempt from the first dawnings of rational theory and sound practice; to their old canon of digesting, incarnating, and cicatrizing wounds.

There is no question that the humours of the eye may be evacuated, and restored again; that the blood may be transfused from body to body, not only with safety but with advantage, especially in hæmorrhagy; and that parts separated will reunite; as an extracted tooth! which will, if put back presently into its socket, reunite with it, and continue a living part of the living body. If a tooth pulled out of the head, laid in a basin, washed in tepid water, and then put again into its own socket, or transferred to another person's jaw, can reunite; there need be no question that an incision being made in a man's arm, and his nostril pared! the flap of skin in the arm may be united to the nose; yet these facts, so nearly allied to the miraculous, in order to be well received, should have been proposed in a very modest way. But it was not so with these discoveries; Burhius and Kerkringius pretended to be possessed of particular medicines, by which they could restore the eye after it had been burst or cut open; Taylor, Woolhouse, and others, pretended to cure the blindness of old age, by extracting the muddy humours of the eye, and replacing them with fresh transparent humours, by which the sight became as clear and fine as in the youngest person*. Many pretended to restore to the aged health and strength, by withdrawing from

* Kerkringius tells his story in the following lamentable terms: That the King of Denmark, who was as skilful in sciences, as clear in governing his realms, one day when he was reading a curious book upon glass-making, written by Andreas Frisius, asked his physician, Burhius, who was standing by, whether this story that the author told in his preface could be true, about cutting the eye open, and letting out the humours, and restoring it again? "O!" says Burhius, "that Theodorus Kerkringius, mentioned there so honourably, is one of the poorest of my scholars in this art." Kerkringius in revenge tells the whole story; how he had heard of Burhius being possessed of this art; how he had wished to ask the secret; and how he was ashamed to propose buying it from a gentleman like Burhius; how he studied and laboured to find it out; and how he succeeded without any obligation to this same Burhius. "*Hoc scio, et hic profiteor me nullo horum modorum oculos restituere; restituere tamen alia prorsus ratione, aliisque a me solo inventis viis addo; nec facere me distinctionem inter albos et nigros, sed quolibet oblato animali, &c.*" "It matters nothing to me whether the eyes be black, brown, or grey, bring me what animal you please, I will cut his eyes open, squeeze out all the humours, give him back to you as blind as a mole, and yet restore his eyesight in a very little while: I have done it often for fun (*experientiæ causa*), and have done it three times on the same dog." Now, this is what Burhius could not do according to Kerkringius, for Kerkringius tells how he was admitted to one of Burhius's exhibitions, which failed, "and the dog goes to this day in the streets of Amsterdam blind of that eye." "*Qui canis adhuc hic Amstelodami vivit quidem sed non vidit illo qui discissus fuit oculo.*"

their system the effete blood, and filling them up with healthy and youthful blood. Purmannus "drew off the blood of a merchant's son at Berlin, who had the leprosy, and infused into him the blood of a YOUNG LAMB, and cured him, to the admiration of many persons *. So much did the rage for these experiments prevail, of transfusing blood, and injecting liquors into the veins, that Purmannus, after mentioning his having cured the falling sickness in several, by injecting medicines through the veins, concludes with saying, "It was also twice tried upon myself; first, when I was grievously afflicted with a sort of leprosy, but then it was not artificially performed. And again, a second time at Anslam, when I was sick of a violent fever, and ordered aqua cardui benedicti to be injected, upon which I was wholly delivered from my fever in less than two days time."

Talicotius, a citizen of Bologna, was a man of great learning and skill; he lectured on anatomy and surgery in that city, and was buried in the church of St. John's, where the Faculty of Medicine erected a statue in honour of him †.

Talicotius begins with observing how trees receive a graft, and unite with it so entirely, as to transmit a new flavour to the fruit. He recapitulates all the arts of ingrafting; and upon the analogy of these rules and practices, he founds his theory of uniting the parts of the human body. He proposes to restore ears, noses, and lips that have been cut off; he pares the defective nostril, so as to make it raw, like the edge of a hare-lip; he cuts deep into the arm, and turns back a flap of the skin, but leaves the piece of skin still attached to the arm, so that it continues in full circulation; he pins it, or sews it to the WING of the nose; ties the head to the arm by one bandage, so that it cannot move; and supports the head upon the neck by another bandage, so as to lessen the fatigue of the posture, and after ten or twelve days undoes the bandages, and cuts the flap away from the arm. If another nostril is wanting, he now makes the adventitious piece of skin raw, and joins it to the second nostril; and when all this is done, he carves out nostrils, and shapes the whole into the right form of a nose. He affirms, that he had done this often; and that not unfrequently the hair grew

* Purmannus, p. 304.

† D. O. M.

Gaspari Talicotio civi Bononiensi philosopho ac medico ætatis nostræ celeberrimo. Cum universam humani corporis anatomen doctissimorum virorum frequentissimo conventu publice administratam facundia methodo ac doctrina admirabile explicavit, ejusque incompertas adhuc partes in lucem prodidit, animi grati et perpetuæ.

upon such noses, so that they needed to be shaved. That all this is possible, I do most certainly believe it actually was performed often; and at this day in India, where cutting off lips and noses is a common piece of revenge, and even a common punishment, an operation equally difficult is performed, when a piece of skin is cut up from the forehead, and turned down, to supply the place of the nose. Hildanus is one of unimpeached authority, who saw this operation of Talicotius performed. Fienus is another, whose book is that of a scholar and a gentleman, who assures us of the truth of his success; and he also remarks, that his statue was erected by the University of Bologna, after having witnessed many facts of this kind *.

As there is nothing unnatural in this operation, as this reunion of divided parts is just such as we procure in more difficult circumstances every day, the doctrine, and all the useful conclusions which would have flowed from it, would not have fallen into such discredit, had it not been for the ignorance of some, who thought to lie the theory into credit, and who undertook to back up this reasonable doctrine of Talicotius with absurd incredible stories! So much less dangerous is it to have a wise enemy than a foolish friend. The learned credulity of Van Swieten is not more particular than the vulgar credulity of Garengeot. This Garengeot had the boldness to stand out amongst the foremost of the defenders of Talicotius, and risked the following tale: "A young fellow, says he, a foldier, reeling out of a tavern drunk, along with some of his companions, got into a quarrel, in which, one of them bit his nose off, threw it into the gutter, and trod it under foot. He picked up his nose, flung it into Mr. Gallin's, an apothecary's shop, ran after the fellow who had done it, and when he returned, Mr. Gallin washed the nose at the well, stuck it with plaster in its place, and in two days after it was firmly united; and Mr. Garengeot, four days after, dressed the nose with his own hands." But this tale, after all, is but a poor one, compared

* In the hall of the Medical Faculty at Padua is a statue holding a nose in the hand, with the respectful epitaph which I have just recited engraved upon the pedestal. This was erected by his contemporaries, and could not be meant as a sarcasm; or if so, it was a very serious and expensive joke. J. B. Cortesius, Mollinetus, and also Reaumeur, in the French Academy of Sciences, declare the successes of Talicotius; and Fienus, p. 168. says very directly in these terms: "Ego etiam testari possum Caspar. Talicotium professorem chirurgiæ in Acad. Bononiensi, plurimos hac arte nasos restituisse, quorum *EGO ALIQUOT RESTAURATOS IN ALIQUIBUS VIDI, ALIOS ACTU FABRICARI.*" "I have both seen finished noses of Talicotius's, and have also seen him actually busied in making them."

with that told in the following terms by Sir Leonard Phiorovant, Knight : " Of the cure of one that had his nose cut off, and set on again."

" In that time, when I was in Africa, there happened a strange, and this was it. A certain gentleman, a Spaniard, that was called Seignior Andreas Guitero, of the age of twenty-nine years, upon a time walked in a field with a soldier, and fell at words with him, and began to draw. The soldier seeing that, struck him with the left hand, and cut off his nose, and there it fell down in the sand, and then I happened to stand by and took it up, and pissed thereon to wash away the sand, and stitched it on again very close, and dressed it with our balsamum artificiato, and bound it up, and so let it remain eight days, thinking that it would have come to matter : Nevertheless, when I did unbind it, I found it fast conglutinated, and then I dressed it only once more, and he was perfectly whole, so that all Naples did marvel hereat, as is well known, for the said Andrea doth live yet, and can testify the same *." The Talicotian doctrine of adhesion is unquestionably true, but not to this extent. I hold it possible to preserve every flap of skin, though almost entirely insulated ! though left hanging by a tag merely ! but those parts which are entirely separated are entirely and irrecoverably dead. I agree with Dionis " that these pretensions are absurd, but we may easily sew up noses, and lips, and cheeks, which are only in part cut away † ;" and yet I know of some men of the first rank in their profession who believe this tale of Garengeot's. One gentleman of very particular abilities carried me to see a man who had chopped off the point of his finger with a tobacco-knife ; it dropped down upon the board before him ; he took up the piece of his finger, clapped it in its place, fixed it with a roller, and there it sticks to this day. I am, I confess, very sceptical with regard, not to the veracity of my friend, but to the explanation of the fact ; may not so small a piece of the finger have rotted after it was bandaged, the remaining flesh upon the point of

* Mr. De la Faye, one of the greatest surgeons of France, was at the pains to try this experiment in various ways. He cut off parts of the flesh and skin in dogs, and fastened them on again as nicely as he could, but to no purpose ; and says Mr. De la Faye, even while I was making these experiments, a certain person having cut himself betwixt the thumb and forefinger, I came in good time to find the piece of flesh, about the bulk of a shilling, which had fallen on the ground disregarded. I applied it as well as possible to see whether it would reunite ; it fell off in scales, leaving such a cicatrix as convinced me of the inutility of all such attempts. La Faye's Principes de Chirurg. p. 370.

† Vide Dionis, p. 64. where he denies absolutely and unconditionally Talicotius's art of making ears and noses out of the flesh of the arm.

the finger growing up to supply its place? But if this be really true, if we can fix on a finger, or a piece of a finger, which has been chopped off, then we have such a suite of facts, that we may in future expect much more extraordinary cures! Mr. Gallin fixed on a nose that had been troden under foot! Phiorovant piffed on another nose, and then stuck it on! and somebody, I know not who, put on a finger! and who knows but we may some day or other need to set on a leg or a head. That no person, in case of any sudden accident, may plead ignorance, I shall here describe the method from the celebrated Rabelais of setting on a head: "Having gone out to search the field for Episthemon, they found him stark dead, with his head between his arms all bloody. But Panurge said, my dear Bullies all, weep not one drop more, for he being yet all hot, I will make him as sound as ever he was. In saying this, he took the head, and held it warm fore-against his cod-piece that the AIR MIGHT NOT ENTER INTO IT*, and other two carried the body. Leave off crying, quoth Panurge, and help me. Then cleansed he the neck very thoroughly with white wine, afterwards he anointed it with I know not what ointment, and set it on very just, vein against vein, finew against finew, and spondyle against spondyle, that he might not be wry necked: This done, he gave it round about some fifteen or sixteen stitches with the needle: Suddenly Episthemon began to breathe, then opened his eyes, yawned, sneezed, and afterwards he let a great ———; now certainly, quoth Panurge, he is healed; and so he was finely, only that he was somewhat hoarse for about three weeks together †.

It is only by a moderate and rational application of this doctrine that our science is to be improved: this property in living parts, of inosculating and uniting again, is indeed so perfect, that we may depend on it with absolute confidence.

* This old doctrine, of "the air entering into it," is elegantly set forth in a new and interesting point of view, by one of the greatest discoverers of the present age.

† Rabelais's father was a physician, or rather an apothecary like Mr. Gallin: We must either suppose that like him he had some quarrelsome fellow come staggering into the shop with his head under his arm, or that this is meant as a satire on all such doctrines. I had added to these remarks, in a former edition of this discourse, the following sentence, which I am now happy to retract. "If we may believe a writer of good abilities, the best modern stories of adhesion as that of a tooth adhering to a cock's comb, are little better than Talicotian tales." Let it be observed, that in saying this I merely quoted the authority of a late writer; but when Mr. Astley Cooper carried me into his museum, among the first things I saw in a corner was a most furious looking cock's head and gills, with a human tooth fixed by adhesion in the centre of the comb. When I fixed my eye upon it, my friend observed me; Ah! says he, "he does stare you in the face?"

This doctrine, modestly applied, has improved the practice of surgery more than any other ; for in wounds and operations there are but two great points to be attended to ; first, the securing the arteries, so that the patient may be in no danger from bleeding, and then the procuring a speedy adhesion, by which the pain, suppuration, waste of substance, and all the other bad consequences of the wound, are prevented.

Upon this principle, we are able to perform things in the regular way of surgery, as surprising as those which passed for miracles in the times when the sympathetic cures were in vogue. In wounds we save much pain, prevent a large suppuration, and great waste of parts, and limit the scar of the greatest wounds often to a narrow and almost invisible line ; and in operations, in place of leaving a broad suppurating surface, we make our incisions of such a form, as to leave but a very narrow wound, whose lips touch each other, and unite together with a scar that is very little perceived, and very quickly formed. In extirpating a testicle, in cutting out a cancerous breast, in dissecting away the largest tumors, we contrive, by saving the skin, to cure in ten days a surface, which, if cut according to the forms of the old surgery, and cured according to the old rule of digesting and incarning the wound, must have taken at least six months.

I would impress upon your minds this rational and moderate approbation of the doctrine of adhesion. Thirty years ago surgeons had no settled ideas concerning it ; it was just then rising slowly into importance ; they had no motive for saving the skin ; or when they had saved it, they did not know how it should be used, nor how much it might contribute to a speedy cure. If they extirpated a tumor, they cut away along with it all the surrounding skin. If they performed the trepan, they performed in a most regular manner that preliminary operation which they chose to call scalping, or in plain terms they cut away six or eight inches of that skin which should have saved the fractured skull from exfoliation, and which should have immediately covered and defended the brain. In amputating a limb, they cut by one stroke down to the bone ; and even when they performed the flap amputation, they dressed their stump and flap as distinct sores. An exfoliation of the bone in these older operations was a thing unavoidable ; without the casting off of the bone the wound could not heal, so that in trepan, amputation, and all great operations, where there was a naked bone, it was part of the surgeon's art and skill to procure exfoliation ; and the filling up, and final healing of their conical stump, was so slow a process, so imperfect, and so

many exfoliations of the bone, with other lets and hinderances intervened, that it is no wonder their imagination was much occupied about the digesting, incarning, and cicatrizing of wounds. Wherever a bone was laid bare, they believed that it must exfoliate before it could heal. Until they saw the exfoliation perfect, till the bone had at least thrown off an outer scale, they would not permit it to heal. They would not lay the skin down in a wound over the shin-bone. If there was a lacerated scalp, they cut the torn piece off; a large part of the scalp cannot be regenerated in less than several weeks or months, and thus they confirmed their opinion by their practice; for very generally in that space of time the whole, or a part at least, of the exposed bone was thoroughly spoiled. These were a few of the mistakes committed daily by the older surgeons, who were well contented with their own theories about incarning and cicatrizing of wounds; too proud of their art, and too little inclined to follow the simple ways of nature.

The discussions which took place among surgeons concerning amputation, and particularly the flap operations, first contributed to the universal introduction of the doctrine of adhesion. The French surgeons, who first invented the flap amputation, declared not only that their flap amputation procured an easy and perfect cure, but that often in three days the flesh of such a stump had adhered. To this O'Halleran replied, with a rudeness and ignorance quite unparalleled. "I would ask," says he, "the most ignorant Tyro in our profession, whether he ever saw or heard even of a wound, THOUGH NO MORE THAN ONE INCH LONG, united in so short a time." "These tales are told," he adds, "with more confidence than veracity. Healing by inosculation, by the first intention, by immediate coalescence without suppuration, is merely chimerical, and opposite to the rules of nature." This was the assertion of O'Halleran, himself an excellent and most judicious surgeon; and all the best surgeons of the present day, as Mr. White, Broomfield, &c. have followed his doctrine and practice, viz. that of dressing their circular stumps, with rolls of fine linen laid within the circle of the stump; and when they amputate by the flap operation, they dress the flap and the face of the stump as separate sores till the twelfth day.

When O'Halleran talked this bold uncivil language about confidence and veracity, he little thought that he should live to see the doctrine of adhesion followed by a universal practice of laying down the flap, and the most ordinary surgeon procuring sometimes a perfect adhesion on the third day. But surgery has im-

proved gradually within these twenty years; observations have been carefully made and published in pamphlets or journals; doctrine and practice have gone hand in hand. The particular practice of procuring adhesion belongs to no one person, but has been passing continually from hand to hand, from one friend to another, the common doctrine and discourse of the day; the practice gradually becoming more extensive in its application, has gained strength, like every practical doctrine, by slow degrees. It was applied first to amputation, then to trepan, then to the extirpation of scirrhus mammæ, then to all great operations, lastly to all recent wounds. If we are more particularly indebted to any one man for the application of this doctrine to amputation, it is to Allanson, who continuing through all his practice to make neat operations, and careful notes, has given us the result in a form and language which makes his writings, notwithstanding the nature of his subject, as pleasant almost as they are profitable to read; and yet (as O'Halleran says on another occasion, p. 222.) "We must not wonder to find some people scarcely known beyond their own sphere of action MODESTLY whispering their claim to this honour;" a quotation which, in its sense and true meaning, may be fairly applied, excepting one word, to a certain modern surgeon*.

* Which of these words, my reader shall strike out, I shall leave to his own honour and good sense to determine, after he shall have read the following quotation; observing, in the first place, that Mr. O'Halleran published his book chiefly with the design of teaching surgeons how to save skin: That Mr. Allanson published his book to teach surgeons how to put that skin down so as to make it adhere; and that a third author, the only modern surgeon who has formally claimed the doctrine, is the only modern surgeon who does not understand its real value. He delivers the following curious history of this doctrine of adhesion: "As I consider the improvement by which these ends are effected as one of the most important in modern practice, I hope to be excused if I shortly state the share I have had in the introduction of it, before proceeding to describe the operation itself.

"In the course of my education, while attending the hospital here as well as the hospitals of London and Paris, the inconveniencies arising from the want of attention to the saving of skin in different surgical operations struck me strongly, so that I was resolved to take every proper opportunity in my own practice of treating this point with particular attention.

"From the year 1772, when I settled in business, I laid it down as a maxim, not to be deviated from, to save as much skin and cellular substance in the removal OF TUMORS, WHETHER CANCERS OR OTHERS, when the soundness of parts admitted of it, as would completely cover the SORES, &c.

"After this had been practised for several years, Mr. Allanson of Liverpool, in the year 1779, published some observations upon amputation, in which a method of operating is described, &c.

"The claiming so late as 1772, or rather 1788 (for that is the date of Mr. Bell's first edition), a discovery, viz. that of saving skin in operations, which was published by O'Halleran in 1765, must excite some feelings very different from resentment; but any one who claims in 1788 the doctrine of ad-

I have been at pains to represent this improvement as gradual and silent, as having obtained by general and common consent, by a slow communication of remarks from friend to friend, till at last the practice was fairly established; and no man could fully claim an improvement, in which every man had some little share. But if surgery be indebted to any particular person for the invaluable improvements which this doctrine of adhesion has brought along with it, it is to Mr. Hunter and the London school.

This universal doctrine and practice of procuring adhesion, has done more for surgery in a few years, and most especially for the surgery of wounds, than any other general observation, not excepting even the greatest of all discoveries, the circulation of the blood. It is now well proved, that skin will adhere to skin, flesh to flesh, bone to bone, and all these parts to each other. One part only of the human body, cartilage, will not adhere. I have seen many proofs that cartilage does not inflame, nor ulcerate, nor give out granulations, nor generate new flesh, or, at least, it does so very slowly. A wound heals over a cartilage, but not by uniting with it. We amputate a toe at the joint, and the flaps unite in two days; but still they have united with each other only, and not with the cartilage

adhesion, which Allanson had so fully explained in the 1779, should be answered, and the answer is plainly this, that several other passages of the same author show that he did not even understand what Mr. Allanson was doing. For example,

“When speaking of the time in which stumps may be expected to heal, I think it right to observe, that it should not be our object to accomplish a cure in the first instance, without the formation of matter; it commonly answers better when effected in the more gradual manner we have pointed out. When a stump heals suddenly, and the edges of the divided skin adhere by the first intention, the teguments are apt to be puckered and uneven, and the ligatures of the arteries are removed with difficulty, &c.

“It was my own opinion that the SECONDARY UNION, recommended by Mr. O'Halloran, is the best; the cure would appear to be in general accomplished more quickly in this way than in any other. Even where the flap has not been applied to the sore till the FOURTEENTH DAY, the cure has been completed before the fourth week; whereas, few if any cures have been effected so early, where the flap has been applied immediately after the operation.”

A man who has invented a doctrine, very generally understands it, at least as well as his neighbours, and pushes his discovery rather beyond the mark. But this author “cares not whether the skin be laid down for adhesion, or whether we dress the flap and the stump as two distinct sores. In short, far from speaking in the enthusiastic passionate tone of one pleading for his own discovery, we may know that this does not belong to him, by the very token which discovered to Solomon which of the two harlots was the mother of the living child; “for behold one of the women said, nay, but let it be neither thine nor mine, but divide it.”

of the joint ; and in a luxated limb, we find that the bone continues displaced, the cartilage never inflames, never unites with the lacerated parts, never in any circumstances adheres ; for the process of adhesion is really this. Either the arteries of opposite surfaces inosculate mouth to mouth ; or, rather, each cut surface throws out a mucus, the lesser arteries of each cut surface elongate themselves, stretching into this mucus, and it is thus, or perhaps by the generation of a new intermediate substance, that the continuity and entireness of the part is so quickly restored. If any one point fail to adhere, there the wound must run into suppuration, because at that point there is a separation of parts, which, being equivalent to a loss of substance, requires the generation of new flesh.

When the opposite surfaces consent and harmonize with each other in their mode and period of action, then they immediately adhere ; and so skin adheres to skin, flesh to flesh. But if one of the opposite parts enters instantly into a lively action, while the other has only a languid action, and enters into that action slowly and at a long interval of time, the action of the one has expired before that of the other has begun ; such parts, therefore, do not conspire nor harmonize in their action ; nor can they unite with each other, but they may live and thrive independently of each other ; and, perhaps it may happen in this way, that opposite surfaces of skin or muscle may seem to be adhering firmly to the parts beneath them, while they adhere to each other only, and merely cover the cartilage or bone, without having any direct connection with those parts. The bone (as we see in an old amputated limb), lives and thrives, is not limited in its new formation by the adhesion of surrounding parts, but grows out into a broad knob of callus or new bone. A gristle also (as in an amputated or luxated joint) retains its pure and lubricated form.

There are no doubt accidents both of the constitution and of the wound which will prevent adhesion ; for if the patient be of a bad habit of body, if he be lying in a foul hospital, and breathing infected air, if he be ill of a fever or flux, or any general disease, then the properties of the body being less perfect, his wound will not adhere ; or if the wound be foul, made with a poisoned weapon, or left with foreign bodies sticking in it ; or if blood be poured out into the cavity of the wound (for blood, in this case, is but a foreign body *) ; or if there be a wounded lymphatic, or wounded salivary duct, a wounded intestine, or a

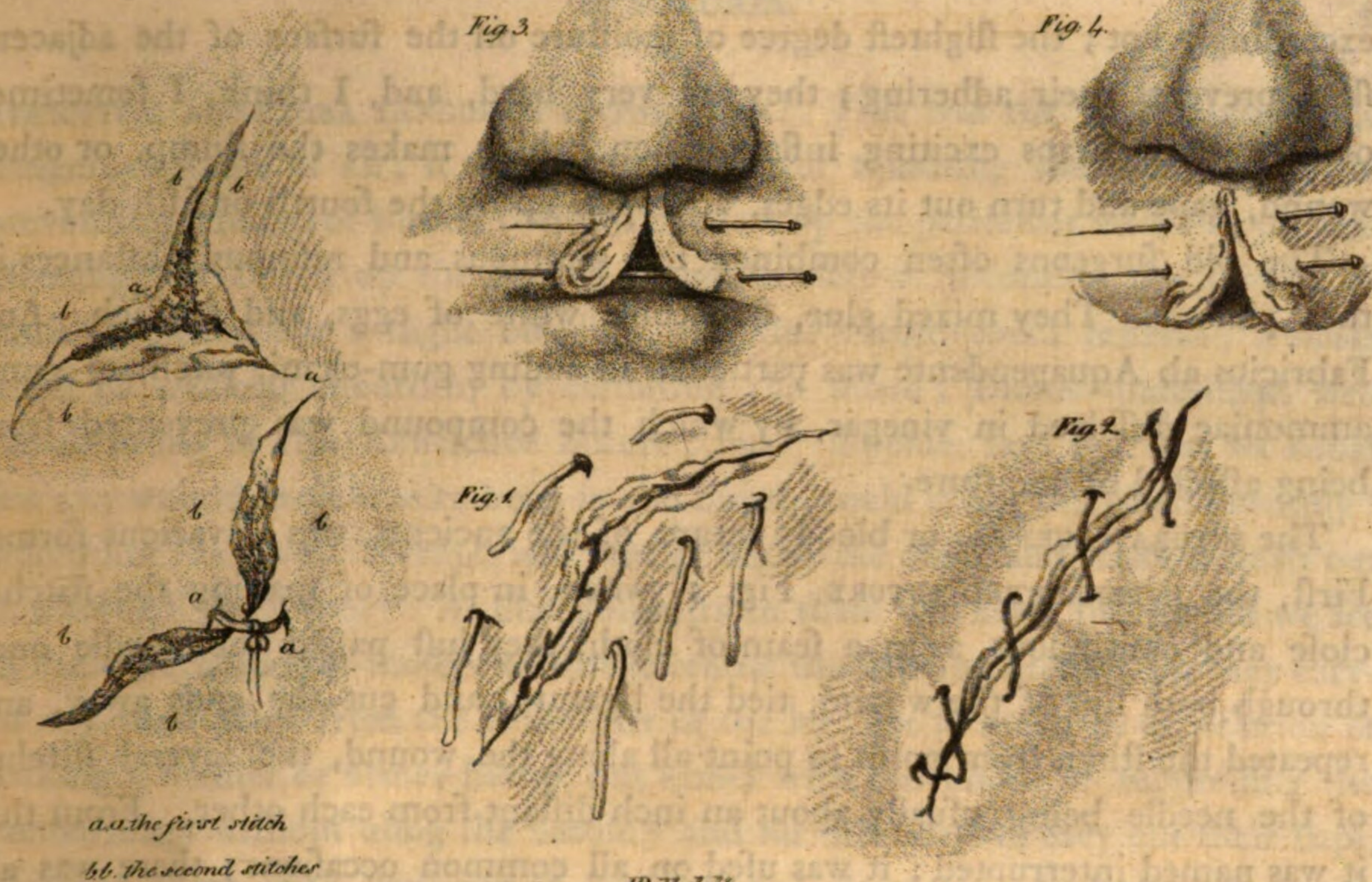
* It is not easy for any one who is not an enthusiast in the " doctrine of life in the blood," to acknowledge all the very extraordinary conclusions which have been deduced from it.

bleeding artery or vein, any of these causes will prevent the immediate adhesion of the wound ; or if it be a bruised or gun-shot wound, and there is a destruction of parts, the lost parts must be regenerated, and those parts which remain must enter into a new action for generating new parts, and so cannot adhere.

This adhesion, then, is a property of the parts of the living body, which is perfect only while their structure is entire, which operates only where the opposite parts touch each other by the fullest contact, and sympathize with each other in their period and degree of action. Adhesion is interrupted if any foreign body be interposed ; it is less perfect in every unhealthy condition of the system ; but it is a property of which we are now so well assured, that we look for its good effects in the greatest as well as in the smallest wounds ; and the union of a hare-lip, after it has been cut and pinned, represents the perfection of that cure which we attempt in every greater operation, and more confidently in every smaller wound, succeeding sometimes as perfectly after an amputation of the thigh, as after the most trivial cut in the cheek.

This property of reunion in divided parts is proved by every day's experience to be so perfect, that where we do fail (which no doubt is sometimes owing to a bad habit of body), we have much reason to suspect some negligence on our own part, some extravasated blood, some open artery, some portion of detached bone left in the wound, or some awkward piece of dressing laid in betwixt the edges of the wound ; we have reason, in short, to blame the want of that absolute contact which is so essential to perfect adhesion ; for every part of a wound which does not touch some opposite surface must suppurate before it can heal ; and this is my chief motive for putting down carefully, in short distinct rules, the several ways in which the sides of a wound may be brought together, so as to adhere perfectly.

There is no wound in which we may not try, with safety, to procure this adhesion ; nothing surely can be more kindly, when applied to a wounded surface, than the opposite surface of the same wound. It has been but just separated ; it may immediately adhere to it ; though it do not adhere, no harm is done ; still the wound will suppurate, as kindly, as freely, as if it had been roughly dressed with dry LINT, or some vulnerary balsam or acrid ointment.



OF SUTURES.

Surgeons have practised all imaginable methods for the uniting of wounds; and very proud they have been of their futures, and still prouder of the names they have given them. The great distinctions have been, the *Sutura Sicca*, and the *Sutura Cruenta*, the dry and the bloody future; the one made with plasters, the other with the needle.

The *SUTURA SICCA* is made sometimes with gum, as in our common court plaster, which is merely gum-arabic, with a little laudanum added to it (and a very foolish addition this laudanum is), and spread upon black silk. The older surgeons often used glue, sometimes they used common glue made of skins, sometimes fish glue, sometimes whites of eggs; for we find that the agglutinative plasters of the old surgeons took two hours in drying, which shows that they were merely made of glue. But these are dissolved by the moisture which flows from a great wound; therefore, in amputation, and all great wounds, we are obliged to betake ourselves to adhesive plasters, made of wax, resin, and oil; though straps of that kind are far from being pleasant to use; for they must be applied

This marginal plate represents the various futures used by the modern surgeon; and as each future is described, the particular figure in this plate explaining such future will be marked.

exceedingly hot ; the slightest degree of moisture on the surface of the adjacent skin, prevents their adhering ; they are very hard, and, I think, I sometimes observe those straps exciting inflammation, which makes the stump, or other wound, gape and turn out its edges, and open up by the fourth or fifth day.

The old surgeons often combined the glutinous and resinous substances in their plasters. They mixed glue, sarcocolla, white of eggs, and mastich : And Fabricius ab Aquapendente was particular in adding gum-elemi, pitch, or gum-ammoniac dissolved in vinegar, by which the compound was prevented from being affected by moisture.

The *SUTURA CRUENTA*, or bloody future, of the ancients, was of various forms : First, the *INTERRUPTED SUTURE*, Fig. 1. when, in place of making the stitches close and continuous, as in a seam of cloth, they just passed the needle once through both lips of the wound, tied the ligature, and cut the ends away, and repeated the stitch from point to point all along the wound, the several stitches of the needle being usually about an inch distant from each other. From this it was named interrupted ; it was used on all common occasions ; there was always something singular in the part wounded, or in the form of the wound, when they proposed using any other manner of sewing.

Secondly, The *CONTINUED SUTURE*, Fig. 2. when the stitches were made all with one thread close, and succeeding each other regularly, as in sewing a piece of cloth. Sometimes they struck the needle through both sides at once ; sometimes they passed the needle through the outside of one lip, and the inside of the other ; sometimes they passed the needle, at each turn, from the inside of the wound only, and that in both lips, whence there was a continual crossing of the thread, and the wound was plaited, so that when the sewing was finished, the seam resembled that of a hand-ball ; this is exemplified in the common manner of sewing up the abdomen, after opening a subject. This continued future was called the Glover's Suture, the Currier's Suture, (*Sutura Paripelliorum*) ; the Shoemaker's, or the Tailor's Suture, according to the peculiar manner in which it was performed.

Thirdly, When the continued future was used in sewing up wounds of the belly, it was called *GASTRORAPHY* ; when the same continued future was used in sewing a wound intestine (though I cannot find that any such operation ever was actually performed), they called it *ENTERORAPHY* ; and when this future was made very firm and close, to prevent bleeding, they called it the *SUTURA RE-*

STRICTIVA, or SUTURA SANGUINIS SUPPRESSORIA. This was the most absurd and dangerous future of all; it was not intended for reuniting the wound, but for preventing effusion of blood; they did not sew up the particular vessels to prevent bleeding, but sewed up the general wound so close as to confine the blood. It must have been but a slight bleeding that this future could restrain; it made a sort of artificial aneurism, by confining the blood; Dionis understood well the absurdity of this Restrictive Suture; for "suppose, says he, that we could sew any wound so close as to keep in the blood, would it not still bleed inwardly? would not that swell, corrupt, and putrify under the skin, and make it burst out in a sort of gangrene?" A like absurdity to these restrictive futures did we see in the expectations of those who first invented the flap amputation, for they carved out their flaps from the fleshy part of the leg, not so much in expectation of making a fleshier or firmer stump, but rather with the hopes of suppressing the hæmorrhagy without using the needle; and for this purpose they cut their flaps, trimmed them with dressings of dry lint and flour, then laid them flat upon the face of the stump, and tied them down firmly with buckles and belts, and all kinds of machinery *.

Fourthly, The HARE-LIP SUTURE was so named from its being chiefly used after operating for that deformity, is one of the few which we have retained. This future is made by thrusting pins or needles through both lips of a wound, and twisting a fine thread round the projecting ends of the pins, whence it is named very often the TWISTED SUTURE †.

* "The way," says Wiseman, "to stop the bleeding, as it is common in all wounds, is by bringing the lips of the wound close together by future, and by applying such medicaments to them as have a drying and agglutinative faculty." These notions our older writers got from the celebrated French surgeon Guido de Cauliaco, who says, "*futura restrictiva fit quando aliæ futuræ non fieri possunt propter magnum sanguinis impetum.*" And he adds, that this after all is not a future to be depended on, for if but one stitch burst, the whole gives way. "*Suspecta tamen est quia rupto uno puncto, cetera relaxantur.*"

Guy de Chauliac had in his turn copied from the Arabians in most points, and very expressly in this business of futures; so that we find the restrictive futures to have begun with the Arabians, who knew the way of using the needle in closing wounds, but had not learnt to use it in tying arteries, otherwise than by sewing the wound just so much the closer and tighter in proportion to the bleeding. They directed the future to be made close and firm, like that which the currier makes when he mends breaches in the tanned skin.

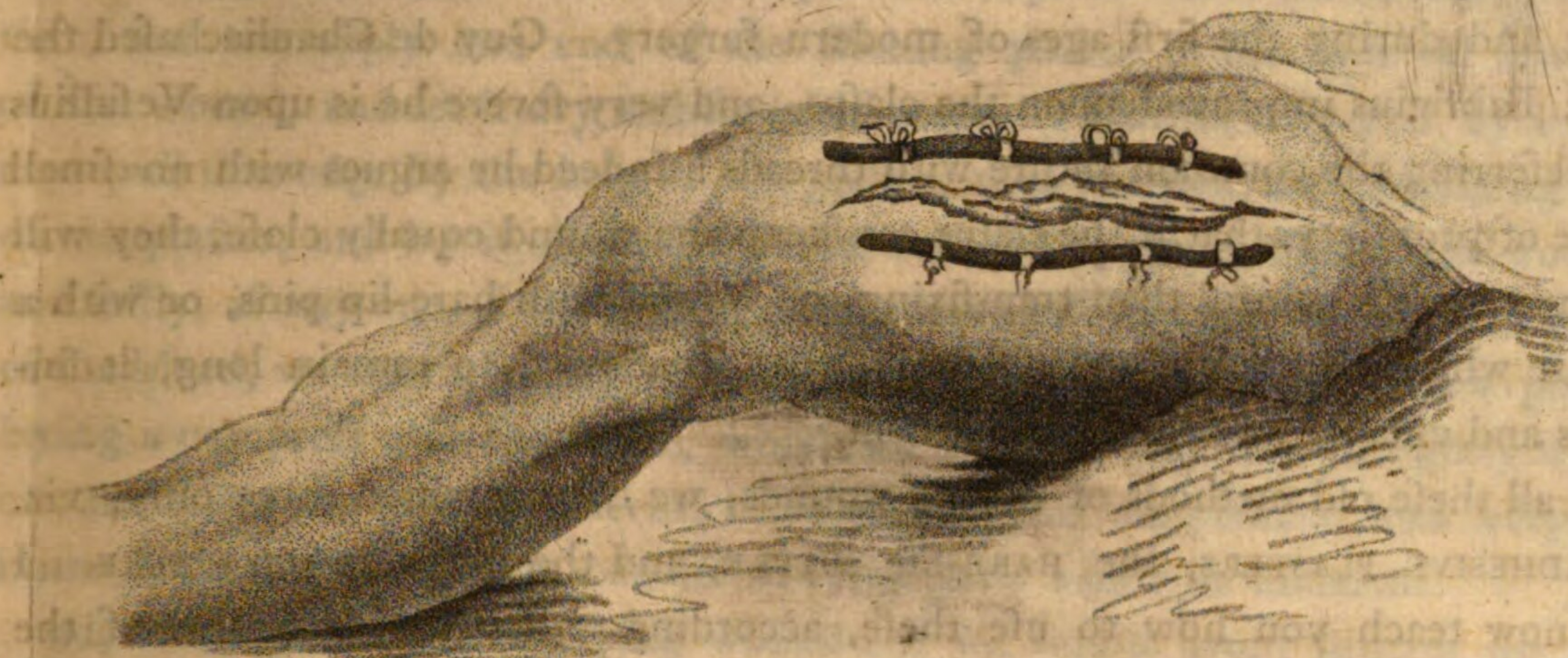
† I have drawn two figures, one to show the proper manner of putting in the pins, the other to show a very common error, which is, that often, as in fig. 4. the lower pin is put in a little way from the lowest or red part of the lip, the consequence of which is, that a considerable part of the lip fails to be reunited;

Fifthly, When the wound was deep among the muscular flesh, the old surgeons imagined that so large a wound could not be commanded by the common interrupted suture, however deep the stitches might be driven among the flesh; they were besides fearful of using the continued suture in deep gashes, lest the wound should be made to adhere superficially, while it was still open within, forming perhaps a suppuration and deep collection of matter. They believed that a great muscular wound could not be safely healed without a degree of suppuration, while they wished to bring it together at the bottom, they were afraid to close it very exactly at the mouth, lest the matter should be collected in the deeper parts of the wound; it was for this purpose that they used what they called the COMPOUND SUTURE, or the QUILLED SUTURE. It is merely the INTERRUPTED suture, with this difference, that the ligatures are not tied over the face of the wound, but over two quills or rolls of plaster, or bougies which are laid along the sides of the wound. In performing this suture, we make first two, three, or four stitches of the Interrupted Suture very deep, and then all the ligatures being put in, we lay two bougies along the sides of the wound, then slip one bougie into the loops of the ligatures on one side, drawing all the ligatures from the other side till that bougie is firmly braced down; next we lay the other bougie, and make the knots of each ligature over it, and draw it also pretty firm; and thus the ligatures, in form of an arch, go deep into the bottom of the wound, and hold it close, while the bougies or quills keep the middle of the wound and the lips of it pressed together with moderate closeness, and prevent any strain upon the threads, or any coarse and painful tying across the face of the wound*.

but in figure 3. I have shown the lowest pin introduced as it should be, struck through the very lowest point of the lip, and introduced first, so as to secure the opposition of the lowest points of the cut edges, for on that chiefly depends the deformity or neatness of the scar.

* Dionis reprobates this quilled suture in very violent terms; but his annotator, De la Faye says, it is good, especially in deep muscular wounds, and that it was approved of by every good surgeon in his day. This quilled suture we hardly ever use; it is not indeed useful; perhaps in wounds of the belly it might do some service.

Fig. 5.



quilted Suture —

Bell del.

Sixthly, The fibula or clasp is an old manner of uniting wounds wonderfully little known. The lips of the wound, instead of being sewed, were laid close together, and then kept in that state by a clasp, which was made thin and elastic to bend to the shape of the part, and had hooks at each end which were fixed into the flesh on the sides of the wound. Celsus is supposed to have mentioned these clasps, though some imagine that he meant merely the loops of common ligatures. But the *Fibulæ* or *Agraphs* of the French and Latin authors are mentioned in books too near the times of Celsus to leave us in any doubt; it is not unreasonable to suppose, that along with the books, the operations of the ancients were revived by the Arabians, who must also have had traditions concerning the particular methods in use in the times of Celsus. Oribasius, in explaining Celsus, describes the *Fibulæ* as made of iron, gold, or brass, somewhat in the form of those with which the cloak was fastened. Guido de Cauliaco calls them hooks, small, elastic, and crooked, to take hold of the lips of the cut wound. Eallopheus, who says that Celsus meant merely the threads of common sutures, forgets that Celsus, in many places, says, "*fibulis impositis, fibulis additis,*" expressions quite inconsistent with this conjecture*. But whether the fibula, was or was not

* The clasp is described by Vesallius in the following terms: "*Quinto et ultimo, hæc futura fit Fibulis, disjunctos atque hiantes vulneris oras committentibus; quæ quidem fibulæ vel majores aut minores, existant, pro ratione ac differentia vulneratæ particulæ, sed ab utraque parte incurvæ, unusque hammus in altero vulneris labro infigatur et versus alterum tendat, in quo et alter hammus eodem modo fixus sit; ut facere solent qui pannos tundendo solent,*" p. 982.

used among the Romans, we know well that it was much in use among the Arabians, and during the first ages of modern surgery. Guy de Chauliac used the clasp; Fabricius improved upon the clasps, and very severe he is upon Vesalius for preferring the common suture with threads: Indeed he argues with no small degree of propriety, that if the clasps can keep the wound equally close, they will certainly be less painful than transfixing the wound with hare-lip pins, or with a ligature which always becomes so tense, that if allowed to remain long, it inflames and cuts its way through the flesh.

Of all these old methods of sewing wounds, we have retained three only, viz. the ADHESIVE PLASTERS, the HARE-LIP SUTURE, and the INTERRUPTED SUTURE. I shall now teach you how to use these, according to the size and nature of the wound; and shall be careful to describe the several ways of uniting wounds, in which the skin only, the muscles, the bones, or the arteries, are wounded. These operations I shall endeavour to describe, so as to give each accident the effect of a particular case; and this, I hope, will prepare you in some decided manner of proceeding, appropriated to almost every individual case that may occur.

RULES FOR THE REUNION OF WOUNDS OF THE SKIN.

1st, Except in those cuts which are so slight as only to require a cloth to be wrapped about the part, every wound ought to be sewed; for I have observed, that though we put the parts nicely together with compresses and rollers, if the needle have not been used, we are never sure of the parts being in absolute contact; we are often disappointed; and when we undo the wound, find it in a state of suppuration; yet there are small cuts where it is unnecessary to pass a ligature with the needle. Wherever the cut is clean, direct, without angles, and the skin not much separated from the parts beneath, and especially when it lies flat and firm over a bone, as on the head, hand, &c. we unite the lips of the wound with a plaster of gum arabic, or common black court plaster cut into slips; and in applying such a plaster, we are careful first to let

The clasp was made of various fashions, sometimes like two hooks joined together, sometimes like a clasp for the shoe, or like a Roman fibula, or like a ring for infibulating boys, but always it was made thin and elastic that it might bend to the form of the part.

the bleeding subside, then an assistant puts the lips of the wound neatly together, and we apply one end of the sticking plaster to the skin on one side of the wound, and let it dry and fix itself there, so that we may pull by it; we next pull that edge by the help of the plaster, then moisten the remaining half of the plaster, and lay it also neatly down over the opposite edge of the wound; and lastly, if any one of the slips of plaster have lost its hold, by the oozing out of the blood, we take it gently off, wipe the surface, and apply a new plaster, laying a compress over the whole, which we bind down somewhat tightly with a circular roller, to prevent internal bleeding, support the plasters, and keep the inner surface of the skin in contact with the parts which lie under it.

2d, In larger and more gaping wounds, if we would avoid stitches with the needle, we must use a plaster much stronger than court plaster, which, being made of gum, is washed off by any accidental moisture, as by the unavoidable oozing of blood or serum from the lips of a large wound. The older surgeons pasted two plasters very firmly, one on each side of the wound, (vide Fig. 7. p. 59.). The plasters were spread with a composition of Colophony, Mastich, Refin, Sarcocolla, &c. mixed with the white of an egg to the consistence of honey, and were allowed half an hour to harden and adhere to the skin*; and then, by strings fixed in the edges of each plaster, the lips of the wound were drawn very nicely into contact, and kept so without pain.

Sometimes we use plasters with strings to support stitches of the needle, or to draw forwards the cheeks in operations for hare-lips, where there has been a great separation; and sometimes we use such plasters with uniting bandages to support the sides of great flesh-wounds, where there has been considerable loss of substance.

3d, In cuts of the lips or cheeks, much neatness is required, as indeed in all futures; but here especially, since a slight irregularity in the lip is a great deformity, and a great reproach to the surgeon. In the lip we can have no security but from the firmest kind of future; the lip hangs loose, and is quite unsupported on its inner surface; it is very dilatable; it moves with the slightest motions of the mouth or jaws, and it is so strongly retracted in laughter and

* "Quibus paratis, lintea ex una parte glutino illinenda sunt, et utrinque prope vulneris labia, ut intervallum sit transversus digitus, et aliquanto minus, per totam vulneris longitudinem applicanda; adherent enim strenue cuti intra HORÆ DIMIDIUM SPATIUM applicata: tuncque licet trahere invicem habenulas ex contrariis partibus, et per anfulas alligare." FABRICIUS.

other emotions, by the muscles of the cheek, that it must be particularly well secured. Though some have pretended to reunite the hare-lip by plasters, I know that, even in a grown person, nothing will secure it but the pin. In accidental cuts, we operate exactly as after operations for hare-lip, or for cancer; we take the pin, fixed in the instrument called *Porte-aiguille*, in the right hand, and holding the edges of the lips together with the fingers of the left hand, transfix both lips with the pin, at points exactly opposite to each other, pushing the pin with the right hand, and resisting and managing the lips with the left; we pass two pins, one exactly in the tip of the lip, through the red and fleshy part (for that secures the evenness and just form of the lip), and another through the middle of the lip, and then twist the waxed thread round both pins firmly, but gently, in the form of a figure of 8.

The pins should be drawn out the second day; they are usually left too long; and the tension of the pins occasions a suppuration, a puckering of the wound, and a visible scar. Pins are recommended in other wounds of the face, especially in wounds of the cheek; but this kind of suture strains the parts too much, is apt upon any slight inflammation to burst its hold, often it leaves a mark, and is in no case a good suture, except in the single instance of a wound in the lip. Yet, perhaps, in the case of the eye-lid being cut by accident, or by the surgeon for the purpose of cutting out tumours from the socket, the hare-lip suture may be used. In these cases I have used a fine slender *White Chaple* needle with great advantage; and indeed I think a common sewing needle, or a glover's needle, which is triangular, preferable in any case to the gold pins*.

4th, In cuts of the face, of the scalp, of the ears, nostrils, or lips, of the throat, or even of the tongue, we use in general a single stitch of the *Interrupted Suture*; and the cases in which more are required do not often occur, though sometimes we meet with them. A man, for example, whose horse falls with

* The first time that I used a common needle was, when one boy had quite divided another's lip with a blow of the bat. I found it go in quite easily with the fingers alone. Mr. Petit speaks of a long and slender kind of needle common in France, called the *Queen's Needles*, and those he always used in preference to any thing he could get in the cutlers shops. If a *porte-aiguille*, as it is called, or instrument for holding and introducing the needle were required, I do not know that a neater or better could be found than the handle of the common *tambouring* needle. But in place of any instrument, I think hare-lip pins are best introduced with the fingers, and should have large heads like those of the largest common pins, and delicate points; and I have no hesitation in preferring steel pins or needles, a little tempered, to gold ones, which are very awkward.

him, being thrown from the horse with great violence, his face lighting among sharp stones, is disfigured with various cuts, each of which requires a separate stitch; or the cut is irregular, of an angular form, and requires a stitch at each angle. Sometimes a sabre cut extends, as it were, along the whole face, or crosses it obliquely; begins in the cheek, crosses the nose, and almost divides the lip. In such a case, we put in a stitch first in the wing of the nose, as being a point, the regularity of which we are anxious to secure, then a second stitch near the tip of the nose, with a very fine needle and thread; then a stitch in the angle of the lip, then another stitch to hold up the middle of the lip, then another in the middle of that part of the cut which extends along the cheek; and the gaps between each of those stitches we cross with slips of sticking plaster. Nor should the surgeon be afraid that the number of stitches, or the closeness of such a future, will excite inflammation; the wound will inflame only at the little points, where it chances to remain ill closed; it is the reunion of parts that restores them to their healthy state, and effectually prevents inflammation*.

But the stitching of such a wound requires very particular niceness; and I will endeavour (as far as rules will go) to teach you the necessary precautions:

* "Whilst I served amongst the Dunkirkers, where Snick and Snee was as it were a fashion, I had much of this sort of work; and, for your diversion, shall set you down one instance in that kind.

"Whilst our squadron rode at anchor in the Groin, there came in some Hollanders, under the notion of Hamburgers, with three ships new trimm'd up for the King of Spain's service. A boatswain of one of these ships happened in company ashore with some of our men, where drinking together, the Hollander began to prate of religion, upbraiding one of our men for wearing a cross; and after a while, growing more heated with drink, he became quarrelsome, and swore Sacrament he would not wear a cross; no, the devil take him, repeating it often. One of our men beat him down, and fell with him; then kneeling upon his breast, and holding his head down, he drew out a knife sticking in his sash, cut him from the ear towards the mouth, then from the os zygoma to the nether jaw. Now, said he, you shall wear a cross, that the devil do not carry you away. I was sent for from the next house as a friend to that religion, and stitched the lips of the wound close together; then sprinkling them with a little pulv. Galeni, applied pledgits with a narcotic unguent, and with astringents and bandage dressed him up. The next morning he was let blood, and the third day after I took off the dressings, and finding the wound as it were agglutinated in the slits, I cut out some of the stitches, sprinkled the wound as at first, and dressed him up with narcotics, with compress and bandage. The second day after I dressed him again, and cut out the remaining stitches; and in a dressing or two more cured him. This being the work of nature, who rarely faileth in acting her part, if we perform ours, in retaining the lips close together, and defending them from fluxion. The patient was well pleased with his cure, though there remained some marks of a cross. These sort of people wearing them with much pride in their faces, as marks of their courage."

Let your needles be smaller and nicer than they are usually made, less curved, and flat, with two very fine cutting edges: Let your threads also be smaller than they are commonly used, and not so grossly waxed, for that makes them stiff and awkward to draw: Let them be a little waxed, in order to flatten, and unite the two threads; but draw them afterwards through your fingers dipped in oil, in order to make them glide through the flesh. Allow the bleeding to cease entirely; if it do not stop use an astringent, as vinegar and water; leave the cut exposed to the air a little, till the bleeding cease, the surfaces grow sore, and begin to smart, and the lips become dry; be in no hurry. Make a stitch of the needle at each angle of the wound; repeat your stitches, one for each inch in length of the wound; draw them till they make the points approach; and having tied your several stitches, cross each intermediate point with a strap of sticking plaster; and take notice that the ancients were so careful as to close up the whole line of the wound, by pouring upon it a vulnerary balsam, which balsam was not a quackish senseless invention; it was what they called Essence of Mastich, or the essence of some other gum; in short it was a spirit-varnish which they poured over the wound; it hardened upon it in the form of a sheath; the part was thus encased in a sort of mould, which was not washed off till after four or five days, when the cure was perfected. Sometimes they varnished the wound with whites of eggs in place of a balsam. Often they strewed over the wound powders of aloes, myrrh, and mastich; and these gums being moistened from time to time with a little spirits of wine, dissolved first, and then hardened into a cake, so that this was equivalent with pouring the balsam or varnish over the part.

5th, Although the lip, nose, ear, or chin, be almost entirely cut off, though the part have turned down, and hangs by the smallest portion of flesh; you are not to despair of reuniting it; you are to lay it up again, fix it with a stitch or two, dress it very close, put a pad of soft lint over it, and make all sure with a bandage adapted to the part*. It is wonderful how parts will unite after they seem to be irrecoverably separated, insulated to all appearance, and seemingly deprived of any adequate supply of blood.

6th, If the tongue be partly cut across, as by falling on the chin when the tongue is lolling out, or by convulsions, (the tongue being checked between the teeth), or

* See the Chapter on Bandages, where there are drawings of proper bandages for the face, nose, chin, &c.

by shot, the part which is divided may be joined with a stitch of the needle ; while, at the same time, the tongue may be confined with a bandage like that invented by Mr. Pibrac for a young lady, who had several times cut her tongue in fits of epilepsy *.

7th, In wounds of the scalp, the old surgeons were afraid to use the needle, though, in truth, the advantages of sewing the scalp are infinite, and the danger is as nothing. This rule, of never sewing wounds of the scalp, proceeded from ignorance and extreme prejudice ; and perhaps their apprehensions (which were so strong, that this rule became universal and absolute) ; perhaps, I say, those apprehensions arose from their observing how often wounds of the scalp went wrong, not considering, that such disasters ensue rather from some more essential injury, as of the bone, or of the brain itself, than from so trivial a hurt as the stitches of the needle.

It is unquestionably less necessary to make stitches, or, at least, to make many stitches, in wounds of the scalp, than in wounds of any other part of the skin, for the scalp rests upon a firm bone ; and a piece of court plaster, a compress, and a well rolled bandage, are often sufficient to keep the wound firm and right ; but wherever the scalp has been largely wounded, it must be sewed. The sewing reunites the edges to each other, and fixes the separated parts to the cranium ; by thus restoring the continuity of the parts, we preserve them all in health and full circulation, we save the bone from exfoliating, and the

* This drawing, Fig. 6. represents the bandage which Mr. Pibrac found very useful to him in the case of a young lady who had bit her tongue almost across in a convulsion fit. Observe first, that stitches may be put into the substance of the tongue, as into any other part, with perfect success. In this way Parée cured three people who had their tongues almost entirely cut across. And, secondly, that I think a bag of this kind for receiving the tongue, the bag being held back in the mouth with this wire, marked (a a), and fixed by a sort of collar round the neck, must be useful both to preserve the tongue, and also to serve as a gag, and prevent more injury in case of a succession of fits ; yet I



confess, the whole invention favours a little of that trifling manner of which many sensible men accuse the French surgeons ; it is perhaps something like what we ridicule in this country by the word nick-nackery ; like the needles invented by the French surgeons for sewing the intercostal artery, or the artery of the dura mater ; yet if I had not a suspicion that it might on some occasion be useful, I should not trouble you with it.

brain from suppuration, and we shorten the cure. Even supposing the worst, that the scalp be so ruined in its vital principle that it must fall into suppuration, yet the trying to unite it to the soft parts can (as I have already suggested) do no harm. The reunion of the scalp is of more importance than the reunion of other parts, in proportion as exfoliation of the scull, or suppuration of the brain, is peculiarly dangerous; therefore, you will consider this as your rule, that in all kinds of wounds of the scalp, you must attempt the reunion by means proportioned to the nature of the wound. If it be small and direct, without any great separation of the scalp, you may unite it with plasters, compresses, and bandage. If the scalp has been rubbed off by falling among stones, if it has been cut down by the stroke of a sabre, or if the integuments have been cut and turned back for the operation of trepan, they should be smoothed down again, drawn together, and secured with a stitch. In boys, such a stitch may be used with peculiar confidence; and in all such wounds, the stitches should be made especially at the angles, and the whole wetted with a little spirits, or some other astringent and stimulant, so as to stop the blood before the wound is sewed up.

If the wound be a triangular flap of the scalp turned back, as in Fig. 8. by a fall among stones, or by a blow, or (as I have seen) by a man's riding under an arch too low for him to pass, it must be laid down again, and fixed with two or three stitches, according to its extent, as in Fig. 9. Or if we have cut up the integuments to perform the operation of trepan, and the incision is in the form of the letter T, as in Fig. 11. (See the plate at the end of the chapter) we pass the needle through each of the corners of the three flaps of skin, and so draw them all nicely together with one stitch *. Or if the scalp has been torn

* This drawing, Fig. 11. at the end of this chapter, is of the head of a fine boy, SAUNDERS, about six years of age, who fell from a terrace nearly fifteen feet high upon pavement. His scull was cruelly fractured, and depressed to a very great extent, in a triangular form. He lay oppressed, vomiting, and bleeding at the nose and ears. An incision of a triangular form was made through the scalp, and the three angles were dissected off; the trepan was once applied, so as to free the corner of the depressed bone; the depression was raised up; and the whole was secured, as represented in the drawing, by one single stitch. The whole of the incisions had entirely adhered in four days; very little was left to suppuration; the boy was entirely easy from the moment of the operation, and in ten days was able to go abroad. The operation was performed by my friend George Wood. It was no doubt an operation which any one could have performed; but I cannot omit this opportunity of saying, I think him the most dexterous operator I have ever seen, his father, my worthy master, not excepted.

back in a femilunar form, by the kick of a horse, for example (as in Fig. 10.), and you have found it necessary to perform the operation of trepan, make two or three stiches with the needle, and bring the parts as close as you can. I have often seen such a wound adhere in two or three days, and heal in six or eight more.



RULES FOR THE REUNION OF DEEP MUSCULAR WOUNDS.

There is a degree of prudence required in the sewing up of great muscular wounds; for stiches, after all, can support only the edges of the wound, while it is the compress and the uniting bandage that must support all below. Deep muscular wounds, therefore, should be secured chiefly by the compress and uniting bandage. Stiches should in such wounds be used with reserve. Those who have used stiches the most confidently, have been forced as suddenly to cut them out again; a point which is well illustrated by the case of a soldier, who being wounded at the Corps de Garde with a sabre cut, across the shoulder, through the belly of the deltoid muscle, his surgeon sewed the wound that night with many deep stiches; these Mr. Pibrac was next morning obliged to cut, on account of convulsions of the arm, which ceased the moment that he had done so *. Such deep futures may be fairly enough compared with the cross stich of Pa-

* Memoires De l'Academie de Chirurgie.

ræus *, which killed the patient, sometimes by convulsions, sometimes by high inflammations, with a total gangrene of the stump.

Yet in all ages it has been the practice to sew muscular wounds. William Clowes, a good old surgeon, but almost as rude as skilful, was among the few in his day who sewed wounds, and he made free use of this needle, however large the wounds. Being at one time highly incensed at the interference of a meddling, bragging fellow, he relates this short case: "A man travelling out of London to the west country was set upon by robbers, and his two cowardly companions ran off, and left him at their mercy. The chief wound he had was in his thigh, where the muscles were so strangely cut at the heads of them, that he was in great danger of losing the use of that member, the knee-pan having fallen down. Clowes sewed the muscles, and laid all close and right; but because he would not promise that the man should walk perfectly, nor fix on a day by which he would be able to ride home, another surgeon was called, whom Clowes inveighs against, and describes in the following terms: He was an idle bragging fellow, often out of breath in quoting authors to maintain his impossibilities. He cut out all my stitches, and laid the wound quite open, saying, that all wounds should be healed open, and from the bottom. Thus was I condemned of insufficiency, and cozened of my patient, and dismissed thereupon." I do not mean by thus quoting a surgeon two hundred years old, to produce authority against authority, nor put his opinion in competition with that of Mr. Pibrac and the French Academy; I mean merely to show you that such deep stitching is an old practice; it was indeed for occasions of this kind that surgeons invented and used the quilled future. We cannot but allow that the sewing of deep muscular wounds, when done with discretion, is a good practice, unless we are to allow, of this bragging fellow's reasoning, that wounds are to be healed open, and from the bottom. There are but two kinds of wounds which come under this description of great muscular wounds, either sabre cuts across the back and shoulders, across the belly (but not penetrating) across the breast, over the buttock, thigh, &c. or plunges of the point of the sabre, sword, or bayonet. In the first of these, viz. in broad sabre wounds, as, for example, in a cut over the shoulders passing through

* The cross stitch was a manner of holding the opposite surfaces of an amputated stump in contact; it was made with a great needle, like a seton needle, with a ligature generally of a pretty broad tape or knitting. It was passed across the face of the stump in two opposite directions, the one tape crossing the other in the centre of the stump, whence it was called the cross stitch. See the Chapter on AMPUTATION.

the rhomboid and Latissimus Dorsi muscles, down to the scapula and ribs; if you allow the wound to suppurate and heal with an interstice, you will find the scar sink very deep betwixt the two edges of the cut muscle. You will perceive that there is a loss of substance, and, of course, a loss of strength, which, not in this case indeed, but in others, may be of great consequence; as, for example, where the bellies of the muscles of the fore arm are cut across, where the bellies of the gastrocnæmii are divided, or in the very case just mentioned, where the muscles which extend the thigh are cut across near the knee-pan. Now observe, that where you sew so great a wound as this, it is not with the expectation of the parts absolutely adhering, but if you keep the muscles forward, up to one another, and nearly in contact for twenty-four hours, or a little more, though they do not adhere, they inflame, they are thickened, the whole flesh in the vicinity of the wound is swelled; the blood and lymph are extravasated, the muscles adhere, as it were, to the parts under them; and though they do not unite with each other, they cannot retract. By this alone a great advantage is gained, for if you allow the muscles to retract while they are hot, bleeding, and moveable, and let them continue retracted till the wound is stiff and inflamed, they become fixed in that position; and even the most profuse suppuration will not loosen them again; they must heal with a gap; and besides suffering from loss of substance, they are apt to become useless, by being fixed and knotted in with the skin and with the parts beneath. These are reasons for sewing every muscular wound; as for Mr. Pibrac's fear of the deep stitches causing inflammation, surely at the worst we have but to do as Mr. Pibrac did, "cut them out."

8th, If then the muscular wound be broad, you must sew it with such stitches as its size, and the mass of parts you have to support may require, trying also to help these stitches, and relieve the strain of the parts by plaster, compress and bandage. If the wound be deep and wide, but without any great vessel wounded, if there be no extravasated blood, nor any thing particular to hinder the adhesion at the bottom of the wound, you may venture to put in one or two stitches, hoping, that if the wound adhere in the lips, it may adhere also within; you may also rest assured, that if it do not adhere at the bottom, the adhesion nearer the mouth of the wound will not make great progress, and can do little harm. If the wound be exceedingly deep, as that made by the stab of a sword, or of a pike or bayonet, you must not think of stitching it, for the mouth of such a wound bears a very small proportion to the wound; you have no command or

the wound by any stitch with which you can stitch the lips of it; this is a wound fit rather for the process of the secret dressing; you squeeze it, wash it, suck it if you will, and you trust entirely to the compress: You put a compress upon the mouth of the wound, and if the blade have passed slanting along, you must lay a long compress, wherever you think it can have any command of the wound, so as to put its sides in contact with each other. Gentle pressure is peculiarly useful. This is the proper case for using the uniting bandage*.

RULES FOR THE REUNION OF COMPLICATED WOUNDS, WHERE THERE ARE
WOUNDED ARTERIES OR FRACTURED BONES.

This principle of adhesion pervades all surgery, and is to guide us not merely in simple wounds, as cuts of the face or head, or lacerations of the scalp, but also in complicated wounds; and I tell you further, I have been at this pains in explaining adhesion, because it is the great practical doctrine in surgery, as inflammation is the chief surgical disease; and you are to keep adhesion always in your thoughts, both in simple and in complicated wounds, not in the first moment only, but throughout the whole cure: you are to have this doctrine of adhesion in view, even where you are sensible that it cannot entirely succeed.

By complicated wounds, I mean those where the arteries are wounded, the joints opened, or the bones cut and broken, and protruding out of the wounds.

9th, In cuts of the wrist, where the radial artery is wounded, or in cuts near the bend of the arm, where many great blood vessels are concerned, or in wounds of the neck, or of the ham, or in the fleshy parts of the thigh, we are often too much occupied with the bleeding, and with the important business of securing our patient from immediate danger, to think of the means of procuring adhesion and a speedy cure. But this is allowing ourselves to be distracted by the hurry of an operation, a thing very unbecoming in a surgeon: We should judge deliberately, and act coolly; we must be careful to perform both operations at once, both that by which the bleeding is suppressed, and that also by which the wound is to be reunited. First, We let go the Tourniquet from time to time, or lift our fingers from the mouths of any vessels that are bleeding smartly: we

* Vid. Chapter on Bandages, fig. 18. the uniting bandage is there represented as applied to the forehead, but it is a bandage more appropriated to the limbs or body.

tie each of these regularly with the needle, and when the arteries are tied, after the general oozing of the blood has also stopped, and the wound become dry, we perform the second part of our operation, viz. uniting the wound itself. If it be on a hard and bony part like the wrist, we lay the lips close together, and perhaps put in one stitch through the skin to keep the lips close. Generally in this kind of wound compresses well applied, and a neat roller, will keep it sufficiently close without stitching; but if the wound be in a fleshy member, as in the thigh or arm, we often make two or three pretty close stitches with the needle.

10th, Where considerable vessels are wounded, we first apply the tourniquet, then tie the arteries; then undo the tourniquet to see that the arteries are really secured; then screw the tourniquet again, that not even an oozing of blood may interrupt our next operation, viz. the closing of the wound; then sew the wound according to its nature and size, leaving the ligatures of the arteries hanging from a corner of it; and though perhaps the whole will not adhere, yet much will adhere, and we always have our chance of procuring a total adhesion. The ligature keeps a little part open for itself, with a slight suppuration round about it, but attended with no pain, and it comes easily away the fourth or fifth day.

11th, When the bone is wounded, or cut, still we pursue our great intention of uniting this complicated wound also, for the bone often adheres, and very probably the reunion proceeds after this manner. We put the bone into its place, and cover it with the skin, keeping all the parts in close contact; the skin adheres to the skin; the bone itself most probably does not, in the strictest sense, adhere to the bone, or at least its adhesion is different in its period, and in its manner, from that of the soft parts. And yet the adhesion of the bone resembles that of the skin, for the outward wound closes; the wounded bone throws out its mucus; that mucus becomes vascular; then bone is secreted; a kind of callosus is formed for uniting the cut bone, and while this process is going on within! The bone seems to have adhered at the very time of the adhesion of the soft parts. It is very particular, that in all fractures, great as well as small, and, of course, in all wounds of the bones, the bone never heals till the outward wound is first healed up, so as to restore the continuity of the vessels, which must be made perfect again, before the secretion of bony matter can begin. If a wounded piece of bone still preserves its connection with the soft parts entire, it adheres again, lives, and is reunited, and the general wound is made to adhere as firmly, having a cut bone in it, as if it were a simple wound! How otherwise

could we make the surfaces of an amputated stump adhere, it being the largest wound, having in its centre the largest cut bone? Therefore, when by a cut of the sabre a bone is divided, when, for example, a man defending his head receives the wound in the fore arm, and has the Ulna cut clean through, or even when both the bones, both Radius and Ulna, are cut across, so that the hand has fallen on one side; if but one of the great arteries of the fore arm remains entire, the hand may be saved; and in order to accomplish this, the ulnar artery, if cut, must be tied, the bones set, by laying the fore arm on a firm splint; the wound itself must be sewed with two or three stitches of the needle. The saving of such an arm so cut across in the middle of the bones, is much easier than when the wound is complicated with an opening into the joint. When a piece of scull is cut up with the sabre, if you put it down again along with the flap of the skin, which it is still attached to, you will find that the bone is so entirely nourished by the pericranium, that it will continue to live, will adhere, and will resume its connection with the scull, just as the flap of the scalp resumes its connection with the soft parts. The process of reunion is the same in a wounded arm.

The surgeon is apt to be alarmed beyond measure at seeing a member almost separated; the thumb of a workman cut off by his tools, and hanging apparently by nothing but a piece of skin; the Tarsus cut almost across by the stroke of the Adze or Axe; or the wrist-joint cut open by the stroke of the Former or Chisel, or almost cut off with a sword, the hand hanging all on one side; or an ankle twisted and almost torn away by machinery, the foot cut nearly away, hanging to one side, the joint opened, and the arteries bleeding. But in all such cases the surgeon must guard himself against the first impression; he must never be in haste to cut such separated parts away, because in the hurry of the moment he is but an ill judge of the proportion of life and circulation which the part may retain; he cannot decide at once whether the part will or will not live; and the part, though separated and dead, by being applied to the sound and living parts, can do them no harm. He should consider always, that if he is to preserve the part, it is by adhesion only, and he is to use all the common means of procuring adhesion. He is not (as I have too often seen done) to lay a limb thus mangled, and which he has some expectation of saving, in a great flush of poultice. The process for saving the hand of a workman, when thus mangled with his tools, is this; you are to take up the arteries first, then return the bones into the wound

if they project, stitch the skin over them, draw together all the open spaces with slips of adhesive plaster, dress the outside, not with an emollient fomentation, or a clumsy relaxing poultice, it must be moistened all over with camphorated spirits, by dipping pieces of lint in the spirits, and laying them along the wound. You are then to wind a roller gently round the part with moderate tightness, in order to keep all firm; and finally, if the joint, as the wrist or ankle, be wounded, you are to lay the part out upon a splint *, as if it were a fractured limb.

12. The more complicated the case, the more anxiously should we desire to reunite the wound. We extend this principle even to COMPOUND FRACTURE, which is the worst kind of wound; for in such case the bones being protruded, the joint being burst up, the capsule torn, and the heads of the bones being displaced and exposed, if we merely return the bones into their place, we do little; the parts are still so far separate that they cannot adhere; they must inflame. It is not from the air getting into a joint so injured that we have pain, swelling, profuse suppuration, and such destruction of substance as endangers the limb; but it is because the parts are suffered to remain separate; for let me once more remark to you, suppuration must come on wherever parts are not joined. By sewing a compound fracture, you will not always make the parts adhere; you cannot ex-

* “A man, in stepping out at a door where a servant was cleaving wood, put his foot upon the billet, just as he was about to redouble his stroke, and the axe went through foot and shoe and all, and the edge of the axe stuck deep in the wood; so that nothing remained undivided of the foot except the last bone of the tarsus, viz. that which supports the little toe. All the vessels being cut, there was of course a great hæmorrhagy, and the man fainted, which happily stopped the bleeding.

The two parts of the foot were put together, and secured with compresses, splints, and a roller; and the man was so thoroughly cured, that when he wanted to satisfy his friends of this at any time, he could stamp with both feet very loudly, and so equally that you could not distinguish the sound foot from that which had been divided across.”

La Motte, p. 310, tells of a French grenadier, who being out marauding, had caught one of the minister's hens, and the minister's servant, a good lusty fellow, came out upon him, and made him give up the hen. He laid the soldier down upon his back, and took his sabre from him. After many earnest prayers he returned it to him; and the moment the villain got it in his hand, he struck at the lad's head, intending to cleave him. He defended himself with his arm; the ulna was quite divided, and part of the radius was cut. He threw the fellow down a second time, and with his left hand alone would have choked him, but was prevented. La Motte cured this man's arm. He cured also another, a dragoon, who, in fighting a duel with one of his comrades, had the shoulder bone cut almost entirely across with the sabre, a little above the elbow; and what remained of it undivided was splintered, but the artery was safe.

pect to cure it like a pure incision of the skin, nor like a wound of the axe or sabre, which divides the bone or the joint with a clean cut, without destruction of parts! Assuredly, in proportion to the destruction of parts, and the violence of the bruise, your chance of reunion is lessened! but even the smallest chance is not to be thrown away. You know, that when the scalp is torn by falling among stones, or by the wound of a bludgeon or of a stone, the parts are so injured that they must inflame, they cannot reunite immediately nor perfectly; the case resembles, in some degree, a gunshot wound; yet such lacerations of the scalp very often are made to adhere partially; and at any rate, if the wound should inflame after being sewed, you have warning of the approaching danger, and can cut out your stitches in good time. So, in compound fractures! even in the wound or laceration of a joint! you are not merely to return the protruding bones; you must lay the lips of the wound, lacerated as they are, as fairly in contact with each other as may be; you must put a little dry lint over the wound itself, and lay soft rolled bolsters of lint upon it, so as to support each of the swelled lips, and keep them close; to your own discretion I must leave it to put in a stitch, or to refrain from it, according to the exigency of the case; but where there is the least chance of escaping suppuration, and procuring reunion, I should advise you to use the needle; for I have seen one or two stitches save the hand of a workman.

“ A slater having fallen from the top of a house, four stories high, upon the pavement, had his life saved by lighting fortunately upon his right hand, which sustained the whole force of the shock in such a manner, that even his head had not touched the ground, and there was no other injury, except the luxation of one of his ribs from its cartilage. The wrist joint was entirely torn; the radius, which of course received the chief part of the force (being the only bone that is properly connected with the bones of the carpus), was terribly shattered; the joint was burst up with such violence, that the hand hung quite on one side towards the radius, and turned as it were upon a point; the small end of the ulna, with its styloid process, projected through the wound, and the hand looked as if spitted upon this bone; the hand was shortened by the manner in which the radius had yielded, for it was shattered and broken into small fragments; and so violently was the hand distorted, that the head of the radius was turned out at the wound, though the wound was chiefly on the opposite edge of the fore-arm, viz. that next the little finger: along with the radius, one of the carpal bones projected through

the wound, quite separated. I cut off the end of the radius with the cutting pincers of an amputation case; I dilated the wound with the knife; and I took up one of the arteries with the needle; I snipped away the carpal bone with the scissors, for it hung only by a rag of tendon and skin. I turned the hand right upon the remaining part of the fractured radius, laid the palm of the hand and the flat inside of the fore-arm upon a firm splint, made a stitch in the lacerated skin of the wrist, to hold it together, and finished by laying a large flat sponge upon the open part of the wound, just a little moistened in spirits, so as to make it spongy, soft and pliant. This closed the laceration so smoothly, that almost the whole of the integuments adhered; the part which failed to adhere was of no great extent. The matter from it was in small quantity and good. In three days it was plain that the hand was safe, and that there would be no gangrene. In about fifteen days the swelling had subsided, the suppuration had become very good, and the parts so close, that it was likely the callus was beginning to form."

"This man was about three months under my care, but it was rather on account of the knotty swelling which surrounded the wrist, and which was very hard to discuss. But at the end of that time the callus of the radius was so firm, that he could use his hand pretty freely; and what was little to be expected, the joint also was restored. He recovered the rotation of the radius, as well as the bending motions of the wrist; and now he finds his hand perfectly useful and strong for work."

13th, There are certainly cases where it were a folly to use the needle, especially where parts are too much lacerated to lie equally together, too much bruised to escape suppuration. We cannot expect that all disordered parts should adhere, but yet a partial adhesion is often of much importance, and may save the part; and though we cannot with any degree of prudence use the needle, the regret of not being able to use it rests upon our mind, we try to make up for this, by laying the parts smoothly together with soft sponges, and little bundles of lint; we also apply slips of lint dipped in spirits; but no poultice, unless where we give up all hopes of saving the member by adhesion.

But there is one case, and perhaps only one, where adhesion is physically impossible, and that is the case of gunshot wound, for there the parts are not merely hurt and lacerated, they are destroyed; they are so bruised by the ball that they are killed, totally deprived of life, and a partial gangrene, and a sloughing of the mortified parts, must precede the cure of every gunshot wound. It is only

after the sloughing, and during the granulation of the wound, that the parts can adhere ; and they adhere not at once, but slowly and successively. These peculiarities naturally forbid stitching a gunshot wound, for that would but raise the inflammation higher, and increase the loss of substance. But we have every motive, especially where flaps of skin or muscle are torn up by shot or splinters, to bring the parts closer and closer as the sloughing proceeds, in order to give each point, as it resumes its healthy action, a chance of renewing its connection with some adjoining parts ; and thus there are certain cases, where a judicious surgeon departing from the established rule, will venture to put a stitch even in a gunshot wound, drawing up the points, not so close and firm as in other cases, not with any expectation of the wound uniting by adhesion at those points where it is sewed, but with the design merely of supporting a flap, in order to preserve it, and keep it nearly in that direction, in which he would like to have it to adhere, for it does adhere in the second period of the cure, when the sloughing is over, and the parts begin to reunite*.

14th, Even in wounds of the belly and breast, it is adhesion of the parts inwardly wounded which saves the patient. It is quiet, perfect silence and composure, and the natural powers, that bring about this adhesion. You lay the mouths of the wound gently and softly together ; you wait patiently the event of this natural process ; you can do little to assist, but you must do nothing to disturb this process. Many a patient died, in the times of the old surgery, by their thrusting tents into the wounds of the belly and breast ; and even now we are too apt to disturb and do harm by an unmeaning and too curious probing of such wounds.

OF CUTTING OUT THE STITCHES.

The last direction which I have to give you relates to the approach of inflammation and separation of the wound, for I cannot allow myself to call it inflammation when the part adheres ; this indeed were no better than to call a cure a disease.

* For examples of cases where stitches may be useful in gunshot wounds, look in the Chapter on Gunshot Wounds for Cases of Wounds of the Face and Throat.

The adhesive inflammation (for it is called inflammation), is not attended with fever, pain, swelling, nor redness, unless in the most trivial degree; that gentle swelling which indicates the fulness and strong but healthy action of the vessels an adhering part must have; but this increased action of the vessels during the reunion of the lips of a wound, stands on the same footing with the healthy action of vessels in forming, or in supporting any part of the system. A bone, for example, is formed and completed by the natural action and fulness of these arteries which are destined to produce it; a spoiled bone is regenerated by an increased action and fulness of the same vessels; the callus which reunites a broken bone is formed by a full but slow and regular action of these arteries which extend from each end of the broken bone, and meet each other; and whenever vessels, extending either from the ends of a broken bone, or from the edges of any wound in the soft parts, meet each other, the part is entire again; they form a perfect system of circulation; from the very first moment of adhesion the vessels of a wounded part resume their healthy action, unaccompanied with inflammation, swelling, or pain; the part is once more entire and sound. If the vessels become thus entire from the very moment of their reunion, if neither pain nor swelling come on, unless the process fail, how can this process be called a disease? Or, by what sophistry can it be comprehended under the definition of an inflamed part? To speak thus appears to me an incorrect and unfavourable view of the matter. It is to describe the cure by the very name of the only disease which can interrupt the cure. I must therefore consider the part as going on in a sound action, while it continues to adhere, and shall proceed in describing what is to be done, if the wound should begin to separate and open, or, in other terms, should begin to inflame.

Adhesion prevents inflammation: when the parts adhere they enter into a healthy action; they are entire, and they do not inflame. Whenever any part is not in contact, and does not adhere, it must inflame: if one point of a wound be left thus separate, its inflammation may extend to the adhering part of the wound, and so one point left thus separate endangers the whole. The stitches, if imprudently made, if drawn too tight, or made too frequent, or made with too coarse a ligature, are themselves a cause of inflammation; inflammation disposes the wound to burst open again, and so the inflammation around the pins or stitches endangers the whole; and sometimes the timely undoing of such stitches prevents this opening of the wound. If there be blood poured out under the

wounded part of the skin, it acts as a foreign body ; it separates the skin from the parts below, which is exactly equivalent to the separation of the edges of the wound itself: this also endangers the whole. From all which you will conclude, first, that whatever prevents the perfect application of the wounded surfaces endangers inflammation. The moment you observe pain, inflammation, and swelling of the wound, a separation or gaping of its lips, the stitches tense, and the points where the stitches pass particularly inflamed, you ought to undo your bandages, draw out your pins, cut your stitches, and take away every thing that is like stricture upon the wound. These prudent measures may abate the rising inflammation, and prevent the total separation of the skin, while you may still endeavour to keep the wound tolerably close, by the more gentle means of sticking plasters.

But should the inflammation rise still higher, and should you perceive that a total separation and turning out of the wound is inevitable, you must throw all loose, put a large soft poultice round the whole, and forsake, without hesitation, all hopes of procuring adhesion. Should you, in this critical juncture, persist in keeping the parts together with futures, the inflammation would, in the form of erysipelas, extend itself over the whole limb, attended with a foetid and bloody suppuration, wasting the skin with great loss of substance. Therefore throw all loose, apply your poultice, allow the wound to separate in its lips, and to pass slowly into a soft and easy state of suppuration ; and then a second time try to bring the edges up to one another, not by stitches, but by adhesive straps, or by a gentle bandage.

DESCRIPTION OF THOSE WOUNDS WHERE ADHESION IS NOT EASILY OBTAINED,
AND OF THE ACCIDENTS BY WHICH ADHESION IS HINDERED.

I fear I cannot have recollected all the rules that may be needful for you ; but if I have taught you the general principles truly, you will be able to add whatever may be wanting, and to accommodate the rules which I have delivered to the circumstances of each particular case ; and yet it is perhaps necessary to recapitulate and explain the various accidents which will prevent adhesion. A wound will not adhere where there is much loss of substance, where it is difficultly drawn together, where the parts are put upon the stretch, where the edges

are not completely opposed to each other, where there is a necessity for many and deep stitches, firm ligatures, or a tight bandage ; for in those circumstances the surfaces inflame ; and whatever parts inflame cannot adhere, neither will the parts adhere when the wound is great, for that is of course equivalent to loss of substance. Thus I remember to have seen a stump more cruelly sewed than even by the cross stitch of Paræus ; it was sewed with seven great hare-lip pins made on purpose ; and though the lips of the stump were easily brought into contact, the stump, from this cruel operation, fell into total mortification on the third day.

When the wound is deep, it does not always adhere ; stitches do not go to the bottom ; the deeper parts remain full of blood, and unopposed to each other ; the sewing up the mouth merely of such a wound must do more harm than good. A gunshot wound cannot adhere, both because the deadening of the parts is equivalent to loss of substance, and because, until the sloughing be over, the dead parts within the wound prevent the contact of those which are alive. If stitches are imprudently used in a gunshot wound, and drawn tight with the intention of procuring adhesion, they must burst out, because a gunshot wound swells on the fourth or fifth day as a prelude to the throwing off the sloughs. A foreign body lodged in a wound, generally prevents adhesion ; for though the foreign body be far down at the very bottom of a deep wound, it inflames the extremity of the wound, and that inflammation extends along the whole tube ; wounds heal sometimes over balls and other foreign bodies, but they heal very slowly and imperfectly. If there be an effusion of blood into the cavity of a wound, that still more certainly prevents adhesion, both as it keeps the parts separate from each other, and as it acts like a foreign body, in distending, irritating, and inflaming the wound. But the circumstance of the surface being kept in any degree separate, is, of itself, a sufficient cause of a wound not adhering ; for parts kept separate must inflame ; when they inflame they cannot unite ; and therefore, a ragged and lacerated wound, the wound made by the crushing of great stones, of mill-wheels, or other machinery, the bite of a horse, dog, or other animal, cannot easily adhere, because, from the irregular laceration, no one surface corresponds with another ; and since the surfaces cannot be put in nice contact, point to point they must inflame, cannot adhere, and must fall into suppuration. Often the inflammation of a bite excites terrible apprehensions lest it should prove to be the bite of a mad animal, though in

ninety-nine of an hundred cases it is from the laceration, from the irregularity of the wound merely that it will not adhere.

The manner also of uniting a wound may be so faulty as to cause inflammation; for if it be left still bleeding at the time it is stitched, if a piece of bone, loose and quite detached, be left in the wound, if part of the skin be turned inwards when it is sewed, if the stitches be too frequent, as in the continued suture of the ancients, or drawn too hard, as in what they called the restrictive suture, for restraining the blood; if the suture do not gently support the lips, but bear upon them with a painful straining; then the stitches themselves are as foreign bodies; the inflammation appears chiefly where the stitches are; and if to these faults be added that of binding a roller too tight round the part, the whole member swells the first day, the stitches are inflamed the second day, and if they be not slackened, or altogether cut out, they burst on the third, and the lips turn out, the wound opens, an erysipelatous inflammation comes on, the parts suppurates with great retraction and waste of substance, and it is fifteen or twenty days before we can make another attempt to close the wound, by bringing up the lips of it gently with compresses and bandage.

But the worst case of all is, when stitches are imprudently made after a wound has already become inflamed; for that is just like the imprudence of cutting off a limb after a gangrene is begun. We may cut off a limb to prevent gangrene; but if the gangrene be already begun, and we cut off a limb, the gangrene, far from being interrupted, will rather be hurried on to its fatal termination. In like manner, we may use stitches in order to prevent inflammation, by reuniting a wound; but if the wound be already inflamed, and the time for prevention be past, then stitches, as they cannot unite an inflamed wound, will hurry on the inflammation to its greatest violence. For I must venture once more to observe to you, that stitches are meant to prevent inflammation, not to cure it; that stitches made while the wound is still fresh reunite the vessels, which, being joined again, soon fall into a calm and healthy action; but if inflammation be once begun, it will not cease. Stitches put into a sound part prevent inflammation; but if driven through an inflamed wound, they increase the disease, and may bring it into a state of gangrene.

An unhealthy constitution is unfavourable to the healing of wounds; but under this head I do by no means comprehend a scrophulous habit of body; for in such habits there seems to be a lively action in the skin, accompanying its

lively complexion, which disposes it to heal very quickly ; so that although, from the slow suppurations of scrophulous glands we should apprehend, that in any such constitution an accidental wound should be very difficult to heal ; we yet find by experience, that a clean cut in a scrophulous person heals with peculiar ease. The unhealthy constitution which I mean, is that which is marked by weakness ; and it is very strange, that men should continue to argue and to practise as if inflammation arose always from high excitement, and from that alone ; he must have observed little who is not satisfied, that it arises, in by far the greater number of cases, from a very opposite cause. It is in unhealthy and weakly constitutions that wounds refuse to unite ; and they burst out the instant that any cause of sudden weakness affects the general habit. If a man be scorbutic, syphilitic, or feverish, ill fed, ill clothed, exposed to cold and moisture ; if he be laid in a foul hospital, prison-ship, or jail ; if he be a prisoner when wounded, depressed in spirit, weakened in body, exhausted with fatiguing marches, confined with many of his fellows in some damp and noisome prison ; if he have lived long in an unhealthy camp, or in a hot climate, any wounds he may have will not unite : or if his wounds have been well and neatly united, and have begun to adhere (but have yet adhered imperfectly), they inflame and burst out again the moment that these circumstances affect his general health : no sooner is he seized with purging, dysentery, fever, or the fits of an old intermittent, than his wounds open afresh. It is debility that causes this inflammation and bursting of wounds ; it is debility, either habitual, or suddenly produced, which converts wounds into malignant sores ; and as scurvy, when it makes its slow progress in the system, ulcerates the gums, opens old wounds, and even dissolves the callus of fractured bones ; in like manner does any cause of sudden debility affect a wound, and make it swell, inflame, and burst its futures.

This reminds me of telling you, in the last place, how important it is to procure adhesion, in the very first moment of a wound ; for the longer this is neglected, the less is the part disposed to heal. A speedy adhesion saves pain and inflammation, prevents suppuration, wasting of flesh, a wide scar, and all the other deformities and distresses of an ulcerating wound. It prevents more serious ill consequences than pain and deformity ; it prevents that bursting of arteries which is so apt to happen in an ulcerating sore, or that oozing of blood which is so much more difficult to command than the most impetuous bursting of sound arteries, and which is always an omen of something still worse approach-

ing. The speedy adhesion of a wound prevents sleepless nights, diarrhoeas, fever, and wasting of the flesh, and the accession of the hospital fever, or hospital fore. You do not know, after a battle, how soon your patient may be thrown into some foul hospital! nay, even in a stationary and well regulated hospital, your patient may be seized with hospital fever, dysentery, or some other disease. If you once get the adhesion thoroughly accomplished before any such misfortune happen, your patient is, in some degree, safe; if you neglect the first moment of healing his fore by adhesion, it may never heal; if he lie but a few days in a foul hospital with an open wound, that wound becomes a fore; the fore is followed with diarrhoea, foul tongue, nausea, and thirst; he becomes sickly; the fore degenerates, he falls into a fever, and dies; his safety, his life, turns often upon this single point, of procuring a speedy adhesion.

Thus, Gentlemen, have I laid before you a short history of the rude and cruel practices of the older surgery, and the first dawnings of this doctrine of adhesion; its general importance in our profession, and its final application to wounds and operations: by it we perform cures more sudden and wonderful, than those which were of old achieved by the secret dressings and sympathetic powders. These which I have laid before you are the CANONS of MODERN SURGERY, which stand in place of those rules which inculcated the Mundifying, Incarning, and Cicatrizing of wounds.



W. Hill del.

the BOY SAUNDERS

Explained 138

DISCOURSE III.

OF ILL CONDITIONED AND COMPLICATED WOUNDS; OF ULCERS, DRESSINGS, BANDAGES, AND THE DAILY DUTIES OF AN HOSPITAL SURGEON.

THE suppressing hæmorrhagy in all dangerous wounds, or the providing for adhesion, is the first great business of the surgeon; but the preserving the health during a tedious cure, the alleviating pain, the preventing suppurations, the procuring the reunion of broken bones, the healing of fistulas, and the curing ulcerated, ill-conditioned wounds, are his daily duties: they are important duties; and if I be not greatly deceived, require more industry, good sense, and professional knowledge, than is usually imagined.

The curing ill-conditioned wounds is a wide and important department of surgery; for under this class we must reckon almost all wounds which do not immediately adhere; all complicated wounds; all those where the blood has been driven inwards among the muscles, where the great arteries are injured, where there is much searching and cutting up of the member, before the bleeding arteries are found; where arteries burst out from time to time, injecting the parts with blood; where the joints are injured, the bones much broken, or where, though the bones are not broken, the flesh which lies deepest has been sorely bruised against the bones, so as to fall into inward suppuration, accompanied with great swelling of the limb.

Gunshot wounds, even in the least dangerous places, though merely in the flesh, are also to be reckoned among complicated wounds; they cannot adhere, both as being gunshot wounds which are unavoidably attended with a partial mortification and destruction of parts; and as balls or other foreign bodies are often lodged deep in the flesh. In such cases the wound, though it cannot heal, yet tends to heal, by which its tube becomes firm, solid, and callous, it pours out a thin ill digested matter, and so degenerates into a fistulous sore.

I have thus described slightly a class of wounds, which it were difficult or impossible to define: the term, Complicated, Ulcerated, or Fistulous Wound, comprehends an infinite variety. Yet it is of singular importance to you, that I should, in the opening of this discourse, lay before you, unequivocally and plainly, the nature of that case which I am about to explain; I am now to explain to you, not any one individual wound, but the various disorders of a swollen ill-conditioned limb. I am to suppose you entered into the wards of an hospital, looking around you upon limbs variously wounded, but all of them lying out, swollen, suppurating, fistulous, rotting in their own filth, having carious bones, bleeding arteries, and a profusion of matter, the patient exhausted in the mean while with diarrhœa, fever, and pain.

If all the ill-wounded limbs in an hospital fall into this condition, the disease may almost be considered as one particular case; and I shall now endeavour to explain to you how much of this disorder is to be ascribed to the unskilfulness of the surgeon, and what part of it arises from the essential nature of the wound. I will endeavour to instruct you in all the daily duties of an hospital, and those are always the most essential duties. I will suppose you, as young surgeons, intrusted with a most important charge; going your rounds through your department of the hospital; observing the condition of each wounded limb, and trying to discover what particularly can be done for each; and followed by the nurses, mates, and servants, with all the necessary apparatus of sponges, towels, rollers, injections, and ointments, setons to draw through the cavities of fistulous sores, and caustics to touch their callous mouths.

If a wound be open, superficial, large and wide; if it be a lacerated wound, such as cannot be reunited; or if it have been stitched, but without success, swelling and inflammation comes on with intense pain and fever; suppuration ensues; the wound degenerates into an open sore; but is rarely accompanied with intense swelling, or any general disorder of the limb.

If a wound be deep and narrow, passing down into the muscular parts; if it be made by musket-shot, and especially if the shot be lodged among the deeper parts! the whole limb inflames, swells, and falls into a general suppuration; and from this critical moment in which it suppurates, every thing depends upon the skilfulness of the surgeon. A limb so wounded, being committed to the care of nurses only, or of ignorant young men, must go wrong; the matter collecting, works its way forwards unobserved, till at last the cellular substance is

entirely destroyed, the muscles undermined, the bones insulated, surrounded with matter, and thoroughly spoiled and carious. The flesh, skin, and cellular substance of such a limb, are all macerated and softened, the joints are swelled and spongy, the whole limb lies a shapeless mass of suppuration; it is irrecoverably diseased; it is inflamed, fistulous, verging towards gangrene, or soaking in suppuration; the health and strength decline rapidly; thence comes on the question of amputation; and that limb which might so easily have been saved, is in danger of being cut off.

When a limb is perforated with balls, or battered with great shot, or crushed in machinery, so that its bones are broken, perhaps protruded, its great arteries wounded, and all its fleshy parts, all its deeper muscles, bruised inwardly against the bones; it often falls into gangrene on the first days; or (if the patient escapes the first danger), into universal disease: the whole limb swells to that enormous degree which threatens gangrene; some parts are very highly inflamed, others slightly gangrenous; the cellular substance, and the interstices of the muscles, are filled with extravasated blood; and in consequence of this extravasation of blood, the suppuration is dark coloured, foetid, and very foul; the skin is much destroyed, the openings numerous and fistulous, the bones carious, the fleshy or muscular parts of the limb wasted: these are inevitable dangers arising, not from the carelessness of the surgeon, but from the essential nature of the wound. Thus would I represent to you the various forms of a complicated wound; the diseases which ensue are among the most important in surgery, and, at the same time, the most neglected; surely, if any skill or conduct can save a limb from falling into this condition, that conduct, and the knowledge which it implies, must form a very serious part of the duties and learning of a surgeon.

Let us, first, then, consider the way in which the most simple wound may degenerate thus. When the adhesion fails, the wound inflames, and all the means which have been used for uniting the wound, serve but to make it open so much the more; you undo your bandages, take off the adhesive plasters, and cut out your stitches; "You throw all loose, allow the lips of the wound to separate from each other, and fall into a soft and easy state of suppuration, and lay the limb in a large emollient poultice." But when the young surgeon extends this good rule, to the suppurating or second stage of such a wound, he mistakes the intention, and offends against reason and common sense; the suppuration is itself a disease

which he should yield to only for a moment ; for no sooner is the suppuration established, and the state of the wound determined, no sooner does the first inflammation subside, than the wound falls next into a state of relaxation and weakness. The violent action of the vessels has ceased, the danger of gangrene is past, and there is established a new disease ! it is now a low inflammation and profuse suppuration which you have to combat ; and the swellings of the limb, collections of matter, frequent suppurations, spoilings of the bones, and destruction of texture among the soft parts succeed each other, step by step, till the limb, if it be not well attended to, falls into irrecoverable disease. This cannot be the disease which is usually named inflammation. This state of a wound cannot require poultices, fomentations, leeches, and a low regimen ; it proceeds merely from relaxation, and requires quite an opposite cure. The patient after the loss of blood, the pain and disorder proceeding from a great wound, has lain continually in bed, and during fifteen or twenty days has enjoyed no rest, has lost his appetite, has wasted in strength, and declined in health, and his limb has been steeped all the while in hot and sour poultices. He has now a degree of fever, a diarrhoea, a furred tongue, a low and weak pulse ; and as for the limb itself, it is turgid and swelled from the trunk of the body downwards ; it retains the impression of the finger like a dropical limb ; it is spongy and colourless everywhere but at the wound ; and even the wound itself, which is supposed to be inflamed, has nothing of a lively inflammation, but, on the contrary, is dusky and livid, with flabby lips, and a foul and gleetty discharge. These are marks of nothing but relaxation, such as will be perpetuated, if the same ways of treatment be continued. In one sense, indeed, I agree with those who think that a poultice will promote suppuration, or force it, for I think that fomentations, poultices, greasy applications, a total want of support, and the filth of its own matter accumulated about it, will keep a suppurating wound for ever in a state of suppuration. Yet these errors are now so common, that they are regarded rather as the regular routine of practice ; and a surgeon is not blamed who, visiting such a leg every day, sees it swelling more and more, and growing daily worse and worse, orders it to be wrapped up again in its poultice ; and ascribes the swelling, and profusion of matter, merely to the inevitable consequences of the wound.

I must truly confess, that while we are improved in all the great and difficult points of surgery ; we are gone backwards in all the nice and delicate attentions, which are so necessary in the cure of wounds. When barbers as-

fecting the character of surgeons, surgeons were forced to imitate their methods of careful niceness in dressing, and became their rivals even in their own peculiar trade of dressing sores; but it seems as if now that surgery has risen to its proper rank; surgeons were even at pains to depart as far as possible from the frippery of this manner, by which many useful methods have been lost, and the practice of common surgery become slovenly to a shameful degree. Long ago a surgeon could never do too much in the way of probing and searching wounds, tenting them to the quick, injecting them with balsams, and torturing the limb with injudicious bandages: but now a surgeon thinks he has done enough in clapping a plaster over a sore with the palm of his hand, or with clean hands he feels the pulse for forms sake, and orders the limb, without regard to its condition, to be laid in a mass of poultice.

This relaxing poultice, which is so easily prescribed, and so indiscriminately used, is good only in the first days of a highly inflamed wound, where there can be no hope of curing by adhesion: it is to be used in all wounds where, having tried to procure adhesion, we find that it will not succeed; where the stitches are bursting, the wound inflamed, the lips swelling, and the parts ready to fall into suppuration; where, in plain terms, our alternative is suppuration or gangrene: where forcing and straining the wound with stitches and bandage would produce gangrene; where we are glad, through necessity, not choice, to throw it loose, and wrap it in poultice, in order to procure suppuration.—In a part so lacerated by a bite, by machinery, by falls, that it cannot adhere, or, at least, must be established in suppuration before it can adhere, poultice is needful.—It is proper also in those great wounds, where men being buried in mines, the flaps of skin which are torn down are choked and mixed, as it were, with coal-flack, or earth; or where a man having fallen among sand, or rough stones, the flaps which are torn down from the scalp or other part, are filled with earth or mud: in all such cases poultice should be first applied; and when the parts are thoroughly cleansed by suppuration, the flaps may be replaced, and then stitches will succeed.—When a limb has been battered by shot, or machinery, or the fall of buildings or mines, so that the bones are broken, the joints crushed, the limb irrecoverably destroyed; if the surgeon has come too late to perform amputation, if he is fearful of gangrene, and is waiting for suppuration, there is no better application than fomentations or poultice.—In the first stage of gunshot wounds, especially where bones are broken, fomentations or poultices may be used; but when the sloughing is over, and the limb falls into a relaxed condition,

we change our plan of cure.—Even in the case of common abscess, though we know of no application so soft and pleasant, so effectual in relaxing the skin, and promoting a suppuration, as poultice, yet the suppuration being perfect, and the abscess burst, the continuing this poultice (as is but too often done) relaxes the parts, and increases the suppuration. Even in this case, the fairest of all for using poultice, we use it but for a time, and for a purpose*.

But when we come to a neglected limb, lying in a flush of matter and foul poultice, we plainly perceive, that this lax swelling, this profusion of matter, and even the attending diarrhoea, nausea, and fever, which surgeons complain of, proceeds merely from their own negligence and ill practice. This relaxing poultice is suffered to be renewed daily, or to lie without being renewed! under the pretext of the wound being a suppurating one; a fomentation perhaps is ordered, with hopes of stimulating the flabby parts to some degree of action, but so carelessly is this fomentation applied, that the joint or the limb receives more cold than warmth, and the bed is soaked with it! for half an hour of warmth and comfort, the patient suffers permanent cold, filth and moisture: and how much harm is done in hospitals by these two applications, it is impossible to express. This condition of the patient is itself a great part of the disease; under this careless treatment the limb grows every day more and more turgid, the suppuration continues to increase, the flesh becomes pale, the wound flabby, livid, and indisposed to heal; the alteration which a sensible change of practice brings about upon a limb so neglected, is very sudden and pleasing.

We remove the poultice, and lay a piece of dry lint into the wound; we use a stimulant fomentation, made of a strong decoction of camomile flowers, with sal-ammoniac and spirits, to cleanse and excite the skin; we dry the limb thoroughly, wrap it up in warm flannel, and remove the foul and moist clothes; we dress the wound the next day with slips of plaster, that the dressings may come easily off, and with soft and fine lint fill up the basin of the fore, laying a flat sponge above the lint to absorb the matter of the wound. The patient, in place of soaking his

* I am sure I see poultice used every day, not “for a purpose, nor for a time,” but from careless habits, and from not observing how soon such applications ruin the texture of a limb. I know of no author, except Belloste, who has rightly observed this, though the practice has now got to such a height, that any man may venture to reprove it, without intrenching himself in authorities. Belloste says, p. 214, “That fomentations contribute much to the protracting of the cure. ’Tis very sure, that these parts drink up the moisture, which softens, relaxes, and puffs up the skin, and, passing through it, fills the parts like sponges; the natural heat of the part is thereby suffocated and extinguished, no perfect concoction can take place but all is turned to matter and corruption.”

limb with a fomentation or poultice, rub in with his own hand some ointment or balsam suited to the condition of the wound. If at certain dependent points, or if round a joint, suppuration is threatened, let him rub in a soft ointment of marsh-mallows, or palm oil; if he is tortured with pain, let him rub the part with laudanum and camphor; if the parts are to be stimulated to a more healthy action, let him rub and stroke the limb with his own warm hand, using camphorated oil, spirits and soap, anodyne balsam, or any stimulant embrocation; let the lips of the wound be supported with soft pledgets of lint, and the whole limb be rolled carefully from the toes upwards, by which the general swelling of the limb will be dissipated, and the healthful action supported, the tumour will be repressed, except at the place of the wound itself, the wound will look florid and healthy, and the patient will be easy, his sleep will return, his diarrhoea will stop, and his appetite will be restored.

But if, to the ill condition of some great wound, there be added a general injury of a limb, the case becomes very complicated and difficult, compared with this mere relaxation of the limb, or bad condition of any single wound; for when the wound is deep, and the opening narrow, the bones broken, or the flesh bruised against the bones, there are various internal parts hurt which successively fall into disease, with great disorder of the whole member. Then the limb swells, with great danger of gangrene, if it escapes the present danger (which is over in a few days), then irregular suppurations ensue, successive abscesses form; the skin swelled up by matter, and, insulated from the parts below, bursts, wastes with suppuration, is perforated with many openings, and at last sloughs and is entirely destroyed. The cellular substance, which connects the muscles with the skin and with each other, is the chief seat of suppuration; and the cellular substance being diseased, the muscular flesh of course suffers, falls into suppuration, wastes during the inflammation, and the abscess is cured only after great loss of substance, and such a knotting together of what remains of the macerated flesh and diseased skin, that the use of the limb is lost; it remains lame, disfigured, shrunk and rigid.

If the suppuration surrounds a joint, there the matter cannot penetrate deep, for the capsule, fasciæ, and all the less sensible membranes which surround a joint, resist the suppuration, but the matter works round the joint, with great pain, misery, and hectic fever; the skin is thickened and puffed up, is perforated by the matter; the whole ball of the joint, as of the shoulder or knee, is massed by inflam-

mation into one confused knot of thickened skin and ligament, while deep abscesses and fistulous openings surround the joint in every direction. If the life be saved in such a case without amputation, at least, the use of the joint itself will be lost.

But if the inflammation go still deeper, and the matter work itself downwards among the muscles, and especially if some broken pieces of bone lead the suppuration inwards, the bones themselves are inflamed, carious pieces of bone are thrown out from time to time, with successive suppurations, and great pain, and the limb becomes thoroughly diseased to the very centre. To the disgrace of our profession, books are full of nothing but bloody operations! yet, what merit is there in performing trepan or amputation, compared with that of curing such a limb?

In the first stage, and while abscess is forming in the limb, you will watch it with incessant care; for an abscess which might be easily cured, often, by being neglected, goes down to the bone. At each dressing you feel carefully all parts of the limb; you allow no complaint of pain, no appearance of redness, no feeling of softness, to pass unobserved. In a disease like this, an abscess does not project from the surface like a boil, but works downwards among the interstices of the muscles, long before the part becomes red. This is an abscess forming in the midst of a great mass of thickening and disease; the abscess is often the flattest part of the limb; and when you feel one part sinking below the level, and the integuments becoming thin; when your fingers sink into a softish hollow, which feels empty, with a hard and knotty border surrounding it, you may be assured the abscess is formed. Then you must open it, lest the matter sink deeper among the parts; you never make a large opening, nor cut up the skin, but use, in place of the broad shouldered abscess lancet, a small bleeding lancet. Strike deep; open the abscess thoroughly, but with an opening so small, that you need press out the matter diligently every day. You will soon discover whether your opening be central, and whether the exit be free; you introduce your probe, and feel whether there be any undermining of the neighbouring parts, any obliquity of the abscess, or whether the abscess be of such extent that a counter opening is required; you squeeze out the matter gently, but with perseverance; and having emptied the abscess, you take advantage of its sides being put together, and endeavour to reunite them; you fit your compress to the shape of the hollow, you make it of soft rolled lint, sometimes you lay on the lint in handfuls; you roll the part carefully, and with such a degree of firmness, as keeps the

sides of the abscess in contact: though you may not procure adhesion at the first, you reduce the size of the cavity, lessen the quantity of matter in a remarkable degree, and in the course of time, you find the parts grow firm, and the sides of the cavity adhere.

By this prudent and careful proceeding, you gain every object; you save the skin from being further destroyed, and the parts within from being further drawn into disease: but if you neglect this opening, the muscles, or even the bones, suffer; if you open the part with an incision, especially in an hospital, the infection comes upon the fore, and the patient dies; if you open it, and then neglect it, the openings grow fistulous, and new abscesses are formed. By opening the wrist joint, in a case of gunshot wound, with a small bleeding lancet, in three points, with these precautions, I have saved the joint; whereas the slightest incisions, in the same wards of the hospital where this man lay, burst out into frightful sores. The older surgeons well knew the art of managing suppurations by a bandage, an art too little studied, or rather too little cared for by the modern surgeon; he orders his poultice, on all occasions! but they were careful to accommodate their compresses to the form of the abscess, and to alter their place as the matter changed its situation. When they rolled their bandage in such a manner as to prevent matter sinking into some hollow, where it might work downwards among loose cellular substance, they called their bandage *FASCIA APOSTHEMA PROHIBENS*; when they pushed the matter before the compress towards some point which they judged safe, they called their bandage *FASCIA APOSTHEMA FACIENS*; and they called it *FASCIA UNIENS* when they obliterated a cavity, by procuring adhesion of its opposite sides. It is not in order to inculcate the same practices that I enumerate these old names, but to remind you of some of the various uses which the older surgeons made of rollers, and which you will do well to imitate, especially in promoting the obliteration of cavities, and the reunion of parts, and in supporting those places which are threatened with abscess.

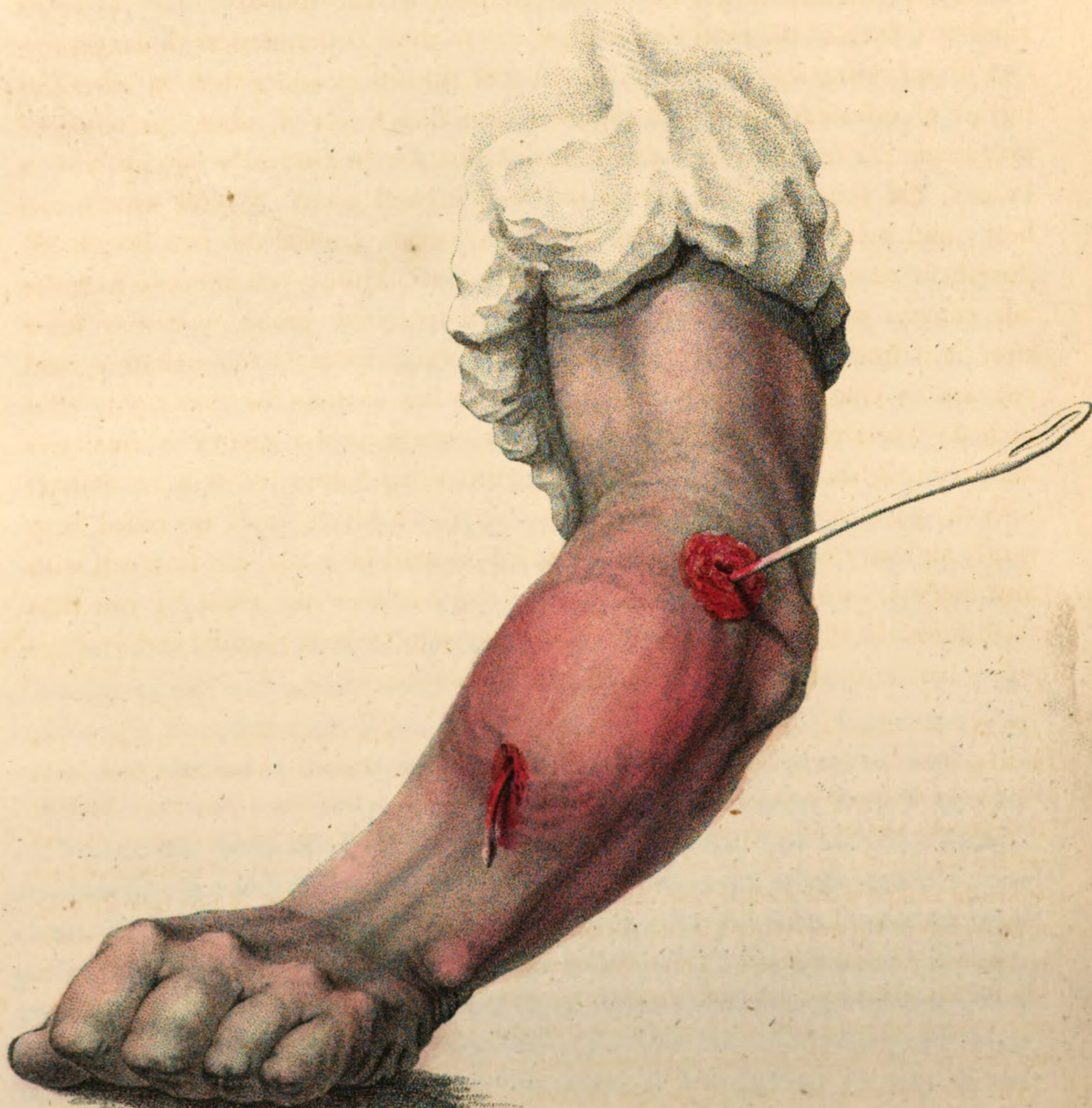
You must learn to vary your practice according to the nature of the case, and especially according to the parts concerned. If the suppuration be on the outside of the fascia, or strong binding membrane of the arm or thigh, then your chief business will be to observe the rapidity with which the matter will undermine the skin; for the fascia, like the membranes of a joint, excludes the inflammation, and resists it; the skin only is inflamed, its cellular substance is destroyed; the skin, by being thus separated from the fascia beneath, is so far deprived of its nou-

rishing vessels, that it is hardly alive ; it is thin, livid, ready to burst, and the least accident will make it slough, and fall off in gangrene. The matter always following the direction of the muscles, falls from above downwards ; if the inflammation be near the haunch, the abscess undermining the skin of the thigh, bursts at the knee ; if in the leg, the matter follows the muscles to the ankle ; if in the fore-arm, it bursts out at the wrist ; and some degree of management is necessary to give a free vent for the matter, so as to preserve the skin.

In gunshot wounds, or in the bruises of great splinters in battles at sea, you will most particularly observe this course of the matter from above downwards. It is from this working of the matter to distant parts that the surgeon, after long searching, is often disappointed of finding the ball, and feels for it at the point most distant from its real place. If, for example, a man is shot with a musket ball in the haunch, the whole thigh will swell, the integuments will be separated from the thigh, the muscles too (especially if the wound be deep), will be, as it were, dissected by the matter ; the chief abscesses will burst near the knee, the surgeon will search there in vain for the foreign body ; the patient will be exhausted by pain and hectic fever, and when he dies the ball will be found lying flattened against the haunch bone, or sticking about the trochanters of the thigh bone : Or a ball passing clean through the fore-arm, the abscesses, which begin to form about the elbow, will extend down to the wrist ; or the elbow being only bruised and slightly wounded with a splinter, the abscess which forms will cover the whole of the bellies of the extensor muscles, and burst at last near the hand.

Here, then, you may easily perceive, that it is not the foreign body lodged in the wound, nor the bruising of the parts, (for a musket ball cuts almost as keenly as a sword) ; but it is the matter itself following the tract of the muscles that causes this extensive disease. Here it is really in your power to hinder the progress of the matter in some degree, and the roller and soft spongy compress which you apply to support the skin will be truly a fascia aposthema prohibens. You must be careful chiefly of these things ; first, To open the abscess early, knowing what destruction the confined matter will make, if left soaking its way downwards through the cellular substance of the skin : Secondly, If you find that it has already made great progress, and that the abscess points below, you must introduce your long probe, pass it down to the very lowest point, and cut it out, so as to make a counter opening, by which the abscess will have from all parts a free discharge : Thirdly, The skin being thus weakened, being already highly

The first of these is the fact that the United States is a young nation. It is only about 150 years old, and its history is therefore a history of rapid growth and change. The second is the fact that the United States is a large nation. It covers a vast area of land, and its population is one of the largest in the world. The third is the fact that the United States is a diverse nation. It is made up of many different peoples, languages, and cultures. The fourth is the fact that the United States is a powerful nation. It has a strong economy, a powerful military, and a significant influence on the world. The fifth is the fact that the United States is a democratic nation. It has a system of government that is based on the principles of liberty, justice, and equality. The sixth is the fact that the United States is a nation of immigrants. It has been built by people from many different parts of the world. The seventh is the fact that the United States is a nation of pioneers. It has a long history of exploration and discovery. The eighth is the fact that the United States is a nation of innovators. It has been the birthplace of many important inventions and discoveries. The ninth is the fact that the United States is a nation of leaders. It has produced many of the world's greatest leaders. The tenth is the fact that the United States is a nation of hope. It is a nation that believes in a better future for all its people.



POOLL.
CAPTAIN of the WASSENAER.

inflamed, unsupported by vessels on its lower surface, its cellular substance being entirely destroyed by the suppuration, there is great danger lest it slough, with a total loss and destruction of the integuments of the fore-arm, for example: injections, even of the most simple kind, are in these circumstances so dangerous, that if unfortunately a stimulant injection be thrown in under such an extensive surface of diseased skin, it will gangrene and slough; or if, under pretence of evacuating the matter freely, this inflamed skin be imprudently cut up with a bistory, the skin must inflame to the very highest point, beyond what it can bear; and being unsupported by its natural vessels, it will die and slough off. For these reasons, then, you never are to use the knife; you are only to make fair counter openings; when you push through your probe, you may draw after it a fine and small seton; but even a small seton is too irritating, and you are to continue it only a few days till the opening be thoroughly established; whenever you are sensible that the course of the matter is free, you must try to lessen the cavity, and to keep this great surface of skin in contact with the parts below by a gentle roller; but the bandage must be rolled very gently and very equally, and your compression must be made, not so much with firm bolsters, as with a handful of plucked lint laid over the whole*; you thus press down the skin that is already injured, so as to make it reunite, and you oppose a barrier to the further progress of the suppuration.

* The two drawings of abscesses in the fore-arm illustrate what I have explained in these remarks. The drawing of the arm of Captain Joannes Marinus Pool, captain of the *Wassinaer*, shows how abscess works along under the skin from the elbow to the wrist. He was supposed to have been shot by a ball, but I am persuaded this was not the case; the wound was made merely by a splinter; the hole was ragged, and was nothing like that of a ball; the wound was so immediately over the bone, that a ball passing here must have broken the condyle of the shoulder bone, and either gone through the elbow joint, or have been felt lying upon the bone. His arm inflamed, and by the tenth day after the battle, the whole skin of the fore-arm was undermined, and ready to slough. I made that opening through which the probe is pushed, just in time to save the skin, and to prevent the abscess reaching the wrist; a seton was drawn through it for three or four days, which brought the parts into so good a condition that it was then withdrawn. The lower opening was preserved, and the skin laid flat, and reunited with compress and bandage.

The other drawing, viz. that of the arm of Charles Challoner, a marine, shows how a ball, passing clear through the arm, produces very nearly the same form of abscess, with a more superficial wound. This man was working a caronade upon the fore-castle, and was among the first wounded in the ship. He was not sensible of being wounded, but observing something drop from him, he stooped to pick it up, and found it was a musket ball. He put it in his waistcoat pocket, and continued working his gun. After his gun had been twice fired or so, one of his comrades called to him that he must be wounded, for that blood was trickling from his wrist. He answered at first, that it could be nothing but the squeezing of

If the inflammation, in place of merely undermining the skin, go deep among the muscles, then the matter finds new cavities and hollows to lodge in, makes new and crooked passages for itself from point to point; one abscess forms after another, the suppurations become very irregular and extensive, and this is what surgeons incorrectly call a fistulous fore. It is not so! for while the parts continue inflamed, and the suppuration good, the disease, however extensive, is merely an irregular abscess; and what is chiefly required is some means of diminishing the number of irregular suppurations, and as it were concentrating the disease; for the surgeon seeing matter confined, the openings narrow and irregular, and new abscesses forming from day to day, is uncertain which way the matter tends. He knows that it is destroying the muscles, and fears that it may be spoiling the bones; therefore he chooses from among the number of openings those two which seem most convenient for his purpose, and introduces a seton from the one to the other; or from one opening he pushes down his long steel probe to the bottom of some recent suppuration, cuts out the probe, and so draws a seton

his fingers under the breech of the gun, but upon looking to his sleeve he saw blood spouting out from a wound near the bend of the arm. Then his comrades made him go down to the surgeon, where, upon turning off his jacket, he found that the ball had passed through his fore-arm. A piece of lint was put upon it, and he laid himself down in the cable-tier, where he was soon after wounded a second time with splinters in the other arm.

The ball must have entered while he was pulling a rope; it entered at the hole which is seen on the fore part of the arm; it passed under the bellies of the supinator muscles, through betwixt the radius and ulna, and passed out at the elbow through the belly of the anconeus muscle. Had such a wound healed easily, and without much swelling of the arm, it should have been let alone; but when it inflamed and swelled up, a free exit for the matter should have been provided; but the opening was narrow, the ball had passed through the thick of the arm, inflammation and suppuration came on, the wounds were so close that the matter was confined; and he endured great torture while the matter wrought its way downwards. The arm was monstrously swelled; the abscess which is represented in the lower part of the arm began to form on the fifteenth day of the wound; it burst through the skin and fascia on the twenty-sixth day of the wound, and the moment that the matter burst out he was relieved from great agony. The lesson which results from this case is very strongly impressed from what the lad suffered. The abscess in such a case should be watched carefully, and opened early, and not allowed to destroy the fore-arm for a month nearly; for though it may be a very good rule in the affair of a common boil, or superficial abscess, to say, "We will wait till it be ripe;" yet in a case where the internal parts are in danger, as soon as we discover the abscess it should be opened; and if the probe passes downwards to any extent, a counter opening in some other dependent point should be also made to prevent a second abscess, and a new bursting of the skin. In this case, by neglecting a counter opening, the lower suppuration broke out into a very ugly, unmanageable and extensive fore; and the lad being thrown into a very foul hospital-ship, there appeared to me little chance of his being cured; yet he did recover after a long while, and with much wasting of the arm.



ARM OF CHARLES CHALLONER MARINE.

through the most central part of the suppurations. This seton is not to be removed when the new opening is established, it is to serve a more important purpose, it is to lead the pus to those particular openings which the surgeon has chosen, it is to prevent the matter working deep among the muscles, and draw into this single channel the matter of all the collateral abscesses. The seton concentrates, as I may express it, the inflammation and suppuration, and brings the disease into one direct line, so that we know where to apply our compress and roller; we so narrow the passages, and lessen the quantity of matter, and empty the collateral abscesses, by the operation of this seton, compression, &c. that in the end the seton may be withdrawn. This seton must be continued during the whole cure; but in such cases injections are never to be used; for this is not a true fistula, but an irregular abscess; the parts, though extensively diseased, are in a natural state of suppuration, the cellular substance is open to an injection; an injection rashly thrown into such an abscess will not be confined to the disease, but pass under parts that are sound: the cellular substance being imprudently injected with any stimulant tincture, the whole limb will swell up, and the swelling and new inflammation will be resolved only by the formation of new abscesses, and more extensive suppurations*.

This is indeed the kind of abscess which often ends in a fistula, but yet it is not one; more commonly a fistula proceeds from some foreign body lodged deep, a ball, a piece of iron, a rag of cloth, or a spoiled bone, which prevents the healing of the wound: and the circumstances and peculiarities of a fistula are very easily and naturally deduced from this cause! for where foreign bodies are lodged in the part, and of course, when foul matter is allowed to stagnate, the part where the ball is immediately lodged cannot easily heal; but the passages where this foreign body is not immediately lodged, recover almost their natural condition, and the only inflammation is at the bottom of the wound, where the foreign body lies irritating and supporting the flux of matter, which must

* It was just this fistulous fore, with various openings, that the ancients called REDUPLICATION VULNERUM; they plugged up the wound with firm tents, and confined the matter; the matter wrought backwards, forming various passages; upon introducing their probes, they found them enter, first one passage, then another; and seeing but one opening and two or more internal passages, they thought the wound was doubled. They said it came about, *Propter tremulentiam manus quæ vulnus infligit. Aut propter motionem agitationemque corporis vulnerati.* They often managed their tents and injections so ill, as to have more than a mere reduplicatio vulneris. They had two or three irregular passages, not so easily accounted for by the trembling of the hand.

find its way out. Such a wound endeavours to heal, but cannot heal : It is a true fistula, the pain and great suppurations have subsided ; even the general lax swelling of the limb is much abated ; or if pain and inflammation comes on from time to time, it is when the openings contract, close upon the matter, and threaten to heal ; the orifices are small, the passages irregular, narrow, deep, and crooked ; the matter thin, ichorous, bloody, sometimes black from the spoiling of a carious bone ; the walls are tube-like, firm, and callous, and so condensed, that an injection thrown into a true fistula cannot, as in an irregular abscess, go abroad into the sound cellular substance.

Here our business is rather to excite inflammation, and provoke the sensibility of the parts. We use setons and injections in this case, with a very different, and much bolder design. Setons are used rough and large, that they may irritate ; they are used, as bougies are (in cases of stricture), to force the parts into a state of suppuration, and to destroy the callosity ; and while they stimulate the callous tube, they make a free passage for pieces of iron, rags of cloth, or carious bones. They are, like bougies, often loaded with irritating medicines, as red precipitate mixed with basilicon, and the cords are drawn through every day. We also inject a fistula sometimes with barley water, merely to cleanse the fistula ; but oftener with tincture of myrrh, along with bark decoctions, to correct a putrid ichor, especially when there are corrupted bones in the fistula, or where blood has been extravasated through the cellular substance, which produces always very foul and foetid suppuration. Sometimes we are really under the necessity of using escharotics, as injections of ærugo with oil, or strong stimulants, as turpentine diluted into the form of a balsam, with oil, basilicon ointment, or balsamum arcæi, which balsams we pour into the fistulous holes hot, but not too strong ; yet for a slightly stimulant and cleaning injection, perhaps there is not a better than rough red wine.

Even small incisions are allowed here. We lay open any smaller fistula in order to get a more direct passage for our seton or injection into the greater fistula, or to enable us to cure and heal up some collateral fistula. We also use sometimes a sponge tent, or piece of gentian, to dilate some particular opening, or to make way for confined matter ; and when, by care, and various inventions and practices, we have obliterated the collateral fistulas, made good counter openings, procured a free vent for the matter, and brought the whole disease into one direct line ; when, lastly, we have brought the tube or inward

surface of the great fistula into the state of an inflamed, active, and granulated sore, and have converted the thin ichor, into a well conditioned pus, we endeavour, with our rollers and compresses, to reunite the parts, forming, by the manner of rolling, what the old surgeons called their Uniting and Expulsive Bandage *.

Wounds with collections of matter round a joint, are the most afflicting of any; the matter is resisted by the capsule, and makes its way round the joint, among the loose cellular substance; it finds out the weak parts, as the axilla or ham, and works towards them, and often it draws the acromion process of the scapula, or the olecranon of the ulna, or any other projecting bone, into disease. The joint then becomes stiffened and deformed, the integuments swell round it; in some parts abscess forms, in others the skin is wonderfully thickened; there is all the appearance of white swelling, but the cavity of the joint itself is not affected, though at last, if neglected, the disease penetrates into the cavity, and the true white swelling, or disease of the joint, is produced. When the shoulder or knee are thus massed by inflammation, hardened, as it were, into a cartilaginous knot, and perforated at all points with fistulous sores, the ligaments of

* It has been long remarked, that nothing is more instructive than stupidity, whether it betray itself, or be detected by others; and I think the following case, which I have extracted from Mr. Ford's useful book on the Disease of the Hip-joint, is an admirable example of this; it is an instance of an ignorant fellow blundering upon the cure of a fistula in the breast, which would have done him honour if either he had intended what he did, or had understood what he had done.

"A. B. a gentleman of sixty years of age, valetudinary in his constitution, subject to pulmonary complaints, was, at the approach of a very severe winter, attacked with a feverish indisposition, which terminated in an abscess in the axilla. It was slow and indolent in its progress, but at length it matured, and was opened freely by the knife. It continued to discharge for several months, sinuses being continually formed, all of which were opened. The wound contracted finally to a small aperture, leading into a sinus which extended far up under the pectoral muscle. The operation of opening or counter opening was in this case impracticable. Irritating tents, the sublimate troches, and injections of various kinds, were used, to produce a coalescence of the fistula, but all proved ineffectual. At length he had determined to content himself with his misfortune; but going out of town, he was overturned in a carriage, and suffered a compound fracture of the arm. He was then necessarily confined to his bed, and the arm kept in a perfect state of quietude. At the end of six weeks he recovered from his fracture, and at the same time had the satisfaction of finding the fistulous sore in the axilla completely united."

And, after all, then, none of these cruel tents and injections were needed; nothing, indeed, but a bandage to bind down the arm, and compress the fistula. This case shows us, that unless a man have a clear intention he can do no good in surgery. This surgeon had made the sides of the tube raw and sore by his injections and tents; he had only forgotten to put the sides of the fistula together, after having made them raw.

the joint are thickened, its motions are lost, and even the partial cure by a stiff joint, or Anchylosis, is hardly to be obtained *. The agonizing pain and want of rest, the diarrhoea, and hectic fever, which are inseparable from this degree of irritation, often destroy the patient, or hurry us on to amputation. But while the diarrhoea and pain can be moderated, while the strength lasts, you should try to cure the disease by varying those practices which I have just mentioned. You should be careful not to relax the parts, nor hurt the little vigour that is left in them, by macerating the joint in a mash of rancid poultice; you should remember, that the skin covering such a joint is much insulated, and tends greatly to inflame, and therefore you should be cautious in using injections! you should be well assured that the parts are really fistulous before you inject, and you should be the more anxious and prudent, because the joint itself may be affected, and you may be driving a very irritating injection into the cavity of a diseased joint; nevertheless, cleansing, or even stimulant injections, barley water, diluted tinctures, or wine, I do not condemn. You should be careful to watch abscesses, and prevent their extension, by small and frequent openings with the lancet; perhaps it may be right to use a seton, in order to procure a free drain of matter. You may occasionally enlarge one fistulous hole, in order to heal up two or three collateral holes depending on it. You should use a poultice only after an incision, when the parts are irritated, and must be appeased; a fomentation you will use often, but you should make it hot and stimulant, and continue it but for a short while; you should support the joint with compresses, or rather puffy cushions of lint, and a gentle roller; but be fearful of tents, which both irritate the parts and confine the matter, rather enlarge the fistulas with the knife. If by a shot, or other wound, the bone be crushed, you easily discover it at first, but not perhaps the whole extent of the injury. If in a scrophulous boy, the acromion, or the sternum, or any other bone, be spoiled by suppuration, you know it by the black and peculiarly foetid discharge; you feel it with the probe through the many fistulous openings which run along the ridge of the bone; a man of experience learns even to know by the eye this state of the sore; and, if there be such a diseased bone, added to the other disorders, and if the bone be projecting at one end, you shake it from day to day till you get it out. Or if diseased integu-

* When such a joint has been saved, but is knotted and hardened into a cartilaginous mass, and the tendons and ligaments about it all fixed, we send the patient to watering places and hot baths, just as we would do a patient with common white swelling; and sometimes he recovers surprisingly.

ments cover the carious bone, having fistulous holes from point to point, you take your round edged scalpel and lay the openings all into one, and take away the diseased bone. Far from sparing the integuments, you should open them freely; you will find them almost insensible, cartilaginous like the tube of a fistula, not bleeding when cut, but rather needing an incision to excite them, and especially needing to be delivered of the diseased bone, before they can enter again into a healthy action, and granulate or unite.

But sometimes those suppurations, though they do not absolutely enter into the joint, draw the Bursae Mucosae into disease, which are, as it were, a part of the joint, of the same structure indeed with the capsule itself. This is a serious addition to the difficulties of the case; the great bursae of the wrist and ankle are, in plain terms, the sheaths of the tendons; those sheaths are particularly close; they enlarge as they approach the wrist and ankle, and are bedewed with a very plentiful secretion: even in their healthy state this secretion of the bursae is in great quantity, but, when the bursae are inflamed, it is astonishingly profuse.

“ A young man of the name of HEARTY, a MARINE on board the ARDENT, was wounded with a long shaft-like splinter of wood, which stuck like an arrow upright in his leg, and was pulled out apparently entire. I had no reason to believe that any foreign body remained in the wound. This shaft had pierced the gastrocnemii muscles, or rather, I think, betwixt the gastrocnemius and soleus, near where the tendon begins. Here was a part certainly destined to inflame; even had the wound been made by a ball passing clean through this part, it must (like the shot which passed through Challoner's arm) have produced inflammation, swelling, and suppuration, among the muscles, and this should have been foreseen, and provided for. The wound, which was a stab with a very rude point (a kind of wound which never fails to suppurate), should have been very freely dilated; for as it was not properly a gunshot wound, there was no sloughing to be expected, such as might open the wound; the very inflammation, which was forming matter within, choked the wound without, and prevented the discharge. The suppuration went on inwardly; the leg swelled to an enormous degree; the original wound, thus closed by inflammation, was so callous, moreover, and so nearly healed, that when this lad came first under Mr. Kiernan's care, it was difficult to introduce a common probe; but when he did get the long steel probe introduced, it passed down nearly to the ankle joint. Mr. Kiernan dilated this upper opening just as he would have done a gunshot wound, and

put into it a fyndon (or small slip of linen) to prevent its reunion, hoping, by compresses and an expulsive bandage, to prevent the matter getting lower. But unhappily for this poor fellow, and many others, Mr. Kiernan was called away to another department *. The matter had now worked its way so low down, that a COUNTER OPENING should have been made; but this was neglected; his roller was awkwardly and carelessly applied, without any decided intention, and the matter continued to work downwards along the Achilles tendon. When I was first called aside in the ward, to see this leg, I do not think there could be less than three pounds of matter collected, reaching from the narrow tented wound in the calf of the leg to the heel, the whole leg swelled to a monstrous size, the poor creature greatly wasted with pain and hectic. I put down the long steel probe, which passed from the small wound above the middle of the leg to the hard skin near the heel; and having cut upon the point of the probe, the matter jetted out, and continued to run in a full stream. It was plain that the bursæ, which accompany the Tibialis Posticus, formed a great part of the disease; but the nature of the disease was very clearly marked by the mixed appearance of the discharge; for before this counter opening the matter being always pushed upwards, it was observed, that the matter which first came up through the narrow orifice was a foul and bloody suppuration, (plainly coming from an abscess of the common cellular substance under the Gastrocnæmii muscles); but what came next was a thin, glutinous, watery-like fluid, which was manifestly pushed up from behind the inner ankle, and plainly indicated a disease of the bursæ mucosæ; from the time of putting in the seton, there was discharged at each dressing (that is, morning and evening), full two pounds of this thin and mixed suppuration; it run out like urine from the wound, horribly foetid. Now you will observe, that from a very slight wound this young man lost his health; he was at the time of my writing his case reduced to extreme weakness; he lay quite melancholy and despairing; indeed should he live his leg will certainly be destroyed †:

* Mr. Kiernan first officiated as surgeon's assistant in the wards, and then was ordered to take upon him the care of the Dispensary, which was a loss to the surgical department. He is a young man of much good sense, conduct, and diligence in his profession, and of such excellent dispositions, that when the troublesome business of his own department was over, he continued to do good service in the wards at every spare hour.

† Mr. Kiernan, at my request, resumed the care of this lad particularly, gave him his wine, porter, and anodynes, with his own hand, and his strength and spirits were somewhat restored. It is just possible that he may be saved. I requested Mr. Kiernan to take once more this charge upon him, because, after having

had he been strong enough to bear such an operation it would have been a charity to have cut it off. You see then the dangerous effects of allowing the disease to work its way to these bursæ; and now, in a second instance, you perceive the sad consequences of not dilating the first wound, of not watching the inflammation, of not hindering the descent of the matter, of not making an early counter opening at the lowest point; and where there is, as in this instance, a deep swelling, inflammation, and suppuration, with a string of tendons and a set of bursæ leading the disease towards a joint, the abscess should be watched with particular care *."

made this counter opening, I found for three successive mornings the clew of seton cut away by some other assistant, and the seton withdrawn, not from any particular opinion, but from sheer stupidity.

* I will here relate the case of a disease in one of the bursæ mucosæ, which is by no means common. It happened to a young man, of the name of M'Gubbin, a carpenter, of twenty years of age, who had his shoulder hurt, or rather sprained, about five months before he came under my care. While assisting to set up a very heavy plank of wood against a wall, he observed it falling, and caught it upon his hand; his arm was beaten back with great violence, and immediately after he felt that his shoulder was much hurt; but it was rather sprained in the violent action of endeavouring to support the log of wood, or in withdrawing with a jerk from a weight which he was unable to support, than by the actual weight; for he was sensible of a violent exertion, but was sure the log never struck his shoulder. Ever since this accident, though he has never been entirely disabled, he has only been capable of doing the lighter kind of work, being always sensible of weakness and pain. About three weeks after the accident he first observed the tumour, which continued very sensibly increasing for a month, and has, he thinks, been increasing ever since. This tumour is very singularly large; it lies like a pillow on the top of the shoulder; the nature of it is by no means easily understood. It is regularly confined to the top of the shoulder, is not very tense, yields a little on pressing strongly with the fingers, but it requires strong pressure, for the tumour is deep seated, lying under all the flesh of the deltoid muscle. The nature of the tumour is not very decidedly marked; but three things are particular: 1st, There is such a distinct perception of fluctuation, that one might almost pronounce that there is a collection of some fluid: 2dly, The subclavian artery, where it comes out upon the breast, beats strongly, and is perfectly free; the pulses at the bend of the arm and at the wrist, are good and strong, or are affected in no greater degree than is fully accounted for by the mere size of the tumour: 3dly, The tumour is limited to the top of the shoulder, lies neatly under the deltoid muscle; the cup of the axilla is quite free, and its edges, the latissimus dorsi and the pectoral muscle, are distinct and clear. It is suspected by many gentlemen in consultation to be an aneurism of the axillary artery; but of aneurism I have no apprehension, unless it were of the small branch which passes round the shoulder, for the tumour keeps clear of the course of the great arteries, and there is no pulsation in it, nor is there that hard lumpy feel which the coagulated blood of an aneurism would probably give. There is no great chance of a suppuration so large in a part so naked as the shoulder joint; our suspicion falls chiefly on the great BURSA, which lies under the acromion process, or the disease may be in the capsule of the joint itself. It may be matter or blood, but more probably it is a gelatinous or serous effusion. The present

But to return to the point of diseased bones: it is a complication of the disorder peculiarly frequent in gunshot wounds; and I have one piece of advice to give you, which if I may guess from the ill consequences of neglecting it, will be of some use. I advise you to take away diseased bones the moment they can be disengaged; for a diseased bone is as a foreign body, which continues the disease, supports the inflammation of the soft parts, and hinders the continuity of vessels, and the generation of callus within. It is, I acknowledge, against all rules of good sense and discretion, to be inexorable in picking away or cutting out every little piece of bone which seems disengaged at the time of receiving a wound;

pain and lameness, the certainty of continually increasing tumour, the fear of its spoiling, or having already spoiled the bones, are strong motives for operation.

This history was written in the hospital-books before the operation, which was performed in the following manner.—

OPERATION. After the outward incision of six inches, some gentlemen still entertained apprehensions of its being aneurism; but upon cutting next through the deltoid muscle, I felt the sac with the point of the finger, and pierced it with a common bleeding lancet; it was exceedingly thin. The puncture just admitted the point of the fore-finger. The matter discharged was not pus, nor was it tinged with the least drop of blood, so that it had nothing of the nature of an abscess. This tumour, instead of a coat of thickened cellular substance, like common abscess, had a thin, smooth, lubricated coat, which proved it to be a **BURSA**, and the fluid was thin, pellucid, gelatinous, mixed with opaque grains, like meal or millet seeds; the quantity must have been two pounds, for the sac now receives two pounds of warm water when injected. After evacuating the fluid, I passed a long probe into the sac, and felt the tendon of the long head of the biceps: The head of the bone and the acromion were found; the internal surface of the bag smooth, lubricated, equable, and the cavity very large, the probe turning freely, by which I had my choice of bringing it out at whichever point I pleased; I brought it out above the axilla, through the broad side of the pectoral muscle, just above the insertion of its flat tendon. I have resolved to clean out the sac daily with warm water, to wait the natural inflammation of the sac; and whenever pus seems to be generated, when the fluid changes from clear and gelatinous to opaque and purulent, to press together the sides of the sac in order to procure adhesion.

On the third day, the matter became very distinctly purulent; I pressed together the inner surfaces of the sac; but now, the sixth day, have made no progress, because in so large and irregular a sac the pressure cannot be made perfectly effectual. I have ordered a large sponge to be used as a compress, and find it answer very well: No hectic fever, nor more pain than what is quite natural: Patient manifestly weaker; I hope that this weakness is from confinement; have ordered him to go abroad daily.

About twelve days after the operation it was reported, that the sac could now receive only a few ounces of fluid. He was ordered to live full, with beef-steaks, wine and bark. On the 9th or 10th of February, that is, twenty days after the operation, he had the usual symptoms of fever; he got a smart vomit, an anodyne; and on the 15th of the month, the fever being gone, the strength somewhat recruited, the discharge from the sac lessened, and the quantity of injection which the sac was capable of receiving being very small, he was sent home to have the benefit of country air.

for at first no man can decide what parts of a bone are disconnected or irrecoverably destroyed; but where a bone has been fractured by a musket ball (which never fails to destroy the organization of the bone), where, in the course of a long suppuration, a bone becomes loose; or where a bone has gradually become carious, and we have observed the disease through all its progress; or where a bone which at the time of receiving the wound did not seem loose, is in the end disengaged by suppuration, the condition of such bone is very unequivocal, and it is equally plain what we ought to do. The sooner such a piece of bone comes away the better: I say comes away, for I would have you to leave this business in some degree to nature: I would have you prudent, but not negligent: I would have you wait till the bone be in some degree loosened by the natural process, but not till it be expelled. Such a carious bone is effectually a foreign body; neither can the integuments recover, nor can callus form, while it remains. While it remains, the sinous ulcer continues without hopes of a cure, a putrid ichor is discharged, and the patient continues to be exhausted with the disease. I know no one good effect of delay; I know no reason why the bone should not be pulled away; it is loose, nature has disengaged it, and perhaps can do no more; if after it is loose you will leave it there, you may leave it for an indefinite time, and the patient will pay the price of your timidity and carelessness. I have seen surgeons who, had it been a ball which had kept the wound open, would have been in great haste to get it out, and would not have been over scrupulous about the means; but a dead and dry bone, worse than a ball, within their reach too, they will not touch, saying, it is to be left to nature, because nature discharges diseased bones! There is no doubt that nature will free herself, in the end, of any diseased bone; but that is no reason why nature should not be assisted; if this were really a reason, it would strike deep against many of the most useful parts of surgery. I have seen a bone sticking for six months, like a truncheon, out of a wound, which one smart twitch with the finger and thumb, or a shake now and then, would have disengaged, even while the patient was asleep. Therefore I give you this advice, to disengage diseased bones as early as you can, without absolute violence; the worst that can happen is, that, by shaking the bone too freely, you give a little pain, or bring a little blood, which is over in a moment. Even when there is a necrosis, or, in other terms, a new bone generating to replace that which is spoiled, where there is a process going on very interesting, and which we are unwilling to disturb, we do not spare even this new shell.

of bone, but split or cut it up, to get out the old one, which protracts the cure; if we do this in cases of necrosis, much more should we cut up the integuments, and pull out a bone which is simply carious *!

When in place of a deep and bruised wound, you have a flat and superficial wound, it often degenerates into a sore; and the methods by which the cure of such sore or ulcer is attempted are very universally known. Occasionally, a sore may be wrapped up in a poultice, or soaked in a stimulant fomentation to cleanse the ulcer, or to abate any pain or inflammation which our medicines may have raised; but a continued use of common poultice, of carrot poultice, of stale beer poultice, or any other, serves rather to relax and hurt the part. I believe, that very universally the cure depends on the prudent use of astringents, escharotics, and caustics, which must be changed according to the condition of the parts, and most especially it depends on perfect cleanliness and a firm bandage. If the sore be going slowly but regularly on, it requires only such slightly stimulant ointments, as Turner's cerate, or unguentum tutiæ, or some other ointment made with zinc. If it be red and fresh granulating, let it be dressed with dry lint in the basin of the ulcer, and straps of ointment round the edge. If the action of the parts flags at times, and the sore looks gleety and pale, sharpen the ointment by adding a little red precipitate to it, or ærugo, or a little dried alum. If the edges are quite callous, they must either be touched with caustic daily, or pared with the knife; for if this be not done, the edge of the skin being by this callosity disengaged from the soft parts, shrinks and wastes. If the sore be flabby, with a profuse discharge, sharpen your ointment by adding to it some spirits of turpentine; the sore will often be so insensible as to require to be fairly powdered with pure precipitate. If at any time these processes for stimulating a sore have been too suddenly entered upon, or too harshly followed up, so as to

* I never shall forget the condition of a boy I saw who had fallen down a hatchway. His scapula was crushed, and his arm bone was broken; the arm bone was left sticking out full three inches, the arm so turned round and distorted that the back of the hand lay upon his rump. He lay in a crooked posture, in the greatest misery, had large poultices, forsooth, laid about his shoulders, and was very cruelly and crossly used by nurses. A creature more exhausted, more wretched, I never saw in all my life. Had the arm at first been extended, and the bone reduced, he must have been a very fine young man; had the bone even been plucked away after it became carious, and before he fell into the last state of weakness, his life might have been saved. The bone was so loose, so entirely carious, and so detached from the sound part of the bone, that it was taken away, not by a twitch, but was lifted easily out as it were from among the flesh, which had no hold on it. I did not see him absolutely die, but am sure he could not live many days.

excite inflammation, you must apply a poultice, or rather a warm fomentation of camomile flowers, with crude sal-ammoniac, till you restore the ulcer to a quiet and easy condition.

But an ulcer, especially a sailer's ulcer, is the opprobrium medicinæ; we have no perfect theory to lead us in our practice; each application has in its turn been proclaimed an infallible cure; but the methods which are extolled to-day, are despised to-morrow*. To commend any of them as infallible, would be very wrong. I would rather leave you to your own good conduct, and to the practice of those methods which you find in every book, and see used in surgical wards from the first day of your entering upon your pro-

* It is impossible to be serious while we enumerate the thousand remedies which have been applied to ulcers; not that our disappointment in removing so afflicting a complaint can be matter for ridicule, but the vain boastings of self-sufficient inventors surely are so. Ulcers have been dressed with precipitate, calomel, alum, vitriol, zinc, verdgrease, pulvis fabinæ, and other DEVILISH DRUGS; they have been powdered with sugar, chalk, charcoal, assafoetida, rhubarb, and other INNOCENT DRUGS; they have been plastered with turpentine, balsams, mel mercurialæ, decoctions of walnut leaves in sugar, (which Belloste protests to be a medicine so powerful that no ulcer can resist it). I have seen ulcers, extending from the os ischium to the ham, or covering the whole back or thigh, like Joiner's, dressed, with what—why with garlic and spirits! while others have thought fit to dress them, like warts, with fasting spittle, or raw beef, or the gastric juice. Ulcers have been squeezed into a good humour by compresses and firm bandaging, strong sticking plasters, plates of lead fastened upon the shins, sponges, cakes of Paris plaster, &c.; or bladders have been fixed about ulcers full of fixed air, carbonic air, vital air: What is there, indeed, that has not been tried. If you should wish to see all this farrago of empiricism treated with the pomp and solemnity of science, look to Mr. Hume's Treatise on Ulcers, in the Surgical Transactions. This singular suite of experiments (as they are called), consisted in trying all sorts of powders; and the precious additions that we have from Mr. Hume are, tartar emetic! true Turkey rhubarb, chalk, Paris plaster, cassia root, lapis calaminaris, ipicacuanha, the flour of mustard, gentian, camomile, Columba root. But I dare say the reader has enough of this. I never heard but of one person who flattered himself with the expectation of becoming the greatest surgeon in Europe, by finding out a cure for ulcers; the birth and death of that gentleman's hopes is related in the following paragraph: “*Id quippe contigit Domino Abbati Bourdilotio, qui me conscius esse, voluit mentis suæ quo tempore una cum illo versarer in Ædibus Condæis sanguinem missurus Serenissimæ Principi. Acri ille fretus judicio animadverterat, in ulceribus adesse, acre quoddam dissolvens, cujus motus inhibendus foret, atque obtundendi aculei admoto quopiam leniente; eapropter ratus est frustra CARNIS VITULINÆ crudæ adplicata excellenti fore remedio; conjecturam hanc suam tanquam arcanum eximium mihi proposuit, CUJUS OPE IN SUMMUM CHIRURGUM EVASURUS ESSEM, CUI PAREM EUROPA NON FERRET, aque insigni verborum energia ad experimentum me impulit in Nosodochio Charitatis: sed res infauste et illi, et mihi successit, neque eventus votis respondit ab humiditate enim carnis vitulinæ in tantum adducta est ulcerum putredo, ut ægri quasi veneficio infecti, in discrimen vitæ adducti fuerint, ac cadaverosa illa medicamina missa facienda fuerint, locum factura remediis ordinariis.*”

profession ; for on this subject I feel myself obliged to speak to you with that reserve and diffidence which is becoming in the present state of our knowledge. This is indeed a subject concerning which the best instructed in our profession would not willingly undertake to give a decided opinion.

Perhaps on this, as on many other occasions, we look too anxiously towards the discovery of some particular cure, while we neglect to investigate the general nature of the disease, the only kind of reasoning which can lead to a just conclusion ; it seems indeed as if, in many instances, we expected the cure of diseases from chance, having no confidence in those reasonings concerning the animal economy of which we are nevertheless so proud. That healthy but strong action which restores wounded parts, by producing adhesion, we have been long accustomed to consider as a stage of inflammation ; and inflammation, of course, has been understood to perform, or at least to assist in the cure of wounds. But I have ventured to protest, that inflammation is unequivocally and always a disease ; that it is inflammation alone that prevents the cure of wounds, or converts a wound into a sore. I would now add, that inflammation either arises at the first from debility, or, at least, very soon produces it ; that the inflammation which causes ulcer is founded in debility ; and that an ulcer happens only in a debilitated part.

The most tedious and persevering ulcers are those which arise from habitual debility ! such are scrophulous and constitutional sores. The most ugly, destructive, and horrible ulcers, are those which arise from some poison infused into the system, destroying the temperament and living powers in the parts ! such as the cancerous or venereal poisons, the siccens, the yaws, the rot poison *. The ulcers which are the most in danger of becoming gangrenous, are those where the vis vitæ of the whole constitution, or of the particular part, is destroyed ; as in dropsy, or in fractures of the spine. The ulcers which are the most fearfully rapid, are those of hospitals and camps, which arise from what I may call a concealed fever lurking in the constitution, which shows itself sometimes in the constitution by an inexplicable disorder, paleness, faintness, nausea, diarrhœa, a quick, hard, and fretful pulse, and a continual threatening of fever ; and frequently by rapid changes of the sore, and even, at times, sudden gangrene without previous fever. The habitual ulcer of warm climates is owing to that uninterrupted

* For an account of the rot poison, vid. Paterfon and Vaillant.

debility of constitution, which shows itself in various forms of disease : sometimes it appears in the form of fever, sometimes of a dysentery, sometimes of intermittent, sometimes the person so debilitated is subject to the liver disease, sometimes to the Cochin or Barbadoes leg, and very often to constitutional ulcer. In those persons with whom the constitutional disorder of warm climates is not so far advanced as to produce spontaneous ulcer, every wound is yet sure to degenerate into a sore ; for in a system thus indisposed and weakened, the living powers of any individual part are apt to be suddenly exhausted, are unable to sustain a high or long continued action ; and hence probably a wound becomes an ulcer, inflames and swells, with a profusion of undigested matter.

These are the various kinds of ulcer arising from constitutional debility ; and every local debility produces in like manner local sores. Of these there are chiefly two kinds, first, That which may happen to any part of the body where, in consequence of a wound, violent inflammation has ensued, carrying the excitement to that height, which the debilitated constitution of the part is unable to bear. Then the parts become flaccid, and run into ulcer, which is to be cured by exciting them, chiefly by those topical applications which I have just mentioned : Or, secondly, A local ulcer may arise from that peculiar weakness of the lower extremities, of which we have so many proofs ; for it is there that leucophlegmatic swellings, varices, ulcers, and all the earliest marks of constitutional debility, first appear.

Of these ulcers, that which is in a manner peculiar to the lower extremities, is by far the most frequent. The cause of this weakness is merely the dependent posture of the parts ; and it is surprising how often we have approached and yet misunderstood the true theory of this disease : to say that such an ulcer is difficult to cure, from the dependent posture of the part, appears too simple and obvious to be thought worthy of attention, and yet it is the truth, and probably the whole truth. This has long been obvious, and yet very little observed ; it is as certainly known that an ulcer of the leg may be cured by keeping it on a level with the body, as that a suspensory bandage is useful in disease of the testicle or scrotum ; an ulcer is cured merely by keeping the diseased limb in the horizontal posture ; the patient walks abroad, and his disease returns ! the surgeon sees the ulcer alternately cured, and breaking out, without ever apprehending that a steady and continued support is the only one thing wanting to a permanent recovery. Here we see the unhappy consequence of not having a

right theory ; hence it is that we travel unconscious, over and over, the very ground where our treasure lies hid ; we have known the true cure for ulcers of the tibia for half a century, we have sometimes succeeded, sometimes failed ; we have at times come near to the perfect practice, then left it off, then resumed it again, and all from not knowing the meaning of the real import of those methods which are used, or the causes of our alternate successes and disappointments. We have long used bandages, leaden plates, adhesive plasters, sponges, and other means of compression, without knowing that it was by supporting the parts that these were sometimes successful. Even a word, a name, is of critical importance in a matter like this ; had any of those who have pretended to cure ulcers by compression had the good fortune to say “ they cured them by supporting the parts,” then would they have caught even by the ear the true theory, they would have been careful not to make partial and painful compression by plates of lead, nor partial strictures by rollers bound only round the diseased part ; they would have been careful to support the parts generally, and to apply their rollers from the very extremity ; their bandages would have taken a very different form ; they would have learnt that manner of bandaging for the cure of ulcer, which I shall explain to you more particularly in my next discourse : at present I shall employ myself rather in pointing out those peculiarities of ulcer which arise from a peculiar condition of the fascia,—from the accidental generation of worms,—from uncleanness, spoiling the texture of the skin,—and from infection of hospital sore, or of any other prevailing disease.

You will very commonly find the general Fascia or tendinous sheath which covers the muscles much concerned in ulcer ; and I am persuaded that the unyielding nature of this part, more frequently than any other cause, protracts the cure. An ulcer seldom penetrates deeper than the skin, it is seldom able entirely to perforate the fascia ; it is the ill condition of this insensible part that makes a sore continue throwing off floughs for months, and spreading continually ; for this tendinous sheath which lies under the skin being dead, deprives the skin of nourishment, by destroying the intermediate vessels ; the skin cannot close over a part which is dead, any more than flesh can close over a carious bone ; nor can it continue sound at its edges, since its edges lie over the dead fascia, unconnected with it, and no longer nourished by vessels : the skin thus shrinks from a part with which it can hold no connection, and the inflammation and the matter working backwards in every direction, destroy more and more the cellular substance which lies betwixt

the fascia and the skin. This I know is the condition of most of those sailors ulcers and hospital sores which I have seen: What can a sprinkling of precipitate, or of some drug still more insignificant, do in such a disease? The fascia, when once brought into this condition, is like a diseased bone, its connections are strong, it does not slough off soon, but keeps its place; the filthy, yellow, thick, and mucous-like matter of such an extensive ulcer, is produced by the gradual melting down of this fascia. When we clean such a sore of perhaps three or four hand's breadth, we cannot but remark the strong analogy betwixt the matter which it discharges, and the stuff which we scrape off from an anatomical preparation, for there also it is the fascia belonging to the interstices of the muscles that produces that foul matter which costs us so much pains to clear away. Upon removing this cream-like stuff from the surface of a deep ulcer, we see the fascia covering the bottom like a sheet of soaked shamoy leather; with such a bottom as this the ulcer can never heal, the fascia itself is dead, and will never recover; it sloughs off more slowly than even a diseased cartilage or bone. Now I know that this is often the impediment to the healing of great ulcers; that the ulcer is perpetuated only from this diseased and yet unyielding state of the fascia, and this has been the occasion of many losing their legs; it is the very ulcer for which many men are reported incurable, and discharged the service. The habit which first produces such an ulcer is very bad; the ulcer itself, which extends so as to uncover the fascia in this manner, cannot be easily cured, although the fascia were cut away; but while it is left the ulcer cannot heal, you must therefore learn to pare and clip the fascia; and it will be some encouragement to you to know that I have often cut it up with the knife, then pared the flaps with scissors, cleared the leg of it in a few days, and brought the ulcer very suddenly into a healthy and granulating state.

When ulcers are long neglected, the worms which breed in them give a dreadful appearance to the disease. This is a shocking accident, very often seen in moist and warm countries, in the autumnal season. In hospitals where men are brought with deep large long neglected sores, worms breed very fast, and most especially in those parts on which the patient lies, so as to prevent its being cleaned; "At Stirling in Scotland, says Wiseman, all those wounded in the back and hinder parts were full of maggots, not having been dressed for some days." Though plainly this kind of ulcer, the *Ulcus Verminosum*, proceeds from uncleanness, from flies being allowed to deposit their eggs in

a nidus, very fit for hatching them, yet with such rapidity are the worms brought forth, and such myriads are found crawling in the basin of a great sore, that one can almost excuse the ignorance of the older physicians, who absolutely believed that the worms were generated by putrefaction merely, without any deposition of eggs; Overcamp was so absurd as to imagine, that the mucus of the guts, or of a sore, might be rolled up into the shape of worms, and at last get life and become real worms*. Christianus Steenvelt, in his letter to Bidloo, was the first who observed the real cause of the generation of worms in sores. He mentions the confused notions of Ruisch as being too equivocal to be understood or refuted; but we can have no difficulty in understanding the opinions of Ruisch; for though in the passages which Steenvelt quotes, Ruisch works up the subject into a fine piece of learned confusion, yet one fact, in another part of Ruisch's works, intimates to us plainly, that he was of the old opinion; I dare say he believed with the other learned people that worms might pass by the blood and circulation into the liver and guts. Upon cutting open some thigh bones (old dissecting-room bones), he found flies in them, and wondered how they got there, never imagining that the flies might deposit their eggs; the eggs ripen into worms, the worms crawl in by holes of the nutritious arteries, to the medullary cavity of the bone, and there become chrysalides, and so change into flies! that the worms and the flies were generated there by putrefaction, was surely the notion of Ruisch. In this state of the matter Christian Steenvelt was obliged to convince the medical world by a very plain experiment: in a case of compound fracture of the tibia, where there was an ulcer of this kind; he scooped out about fifty worms from the crater of the great ulcer, laid them by the kitchen stove, and gave them to the servant girl to nurse, which she did so faithfully, that they fed and fattened, changed into chrysalis, and on the fourteenth day became flies†.

I never shall forget the sight I once saw in our well regulated and cleanly hospital, where there was such an exhibition of ULCERA VERMINOSA, as perhaps never was seen even by Paree at the siege of Turin. Dr. Aitken had taken

* Miravi fati non possum Overcampium, eo devenisse dementiæ, ut statuere non fuerit veritus, motu vermiculari materiam putrescentem posse converti, parari, disponi, formari, in vermes.

† Vermes numero quinquaginta vivere moveri crescere ceperunt, hi capsula inclusi calidoque in loco depositi spatio sex dierum in chrysalides five corpora oblonga duriusculo cortice vel cute contexta, efformabantur FAMULA MEA HÆC FOVENTE SOLICITE post quatuordecim dies in muscas mutabantur

an apprehension that we were too apt to trouble sores by officious dressing, and being deceived, like many others, by the wonderful reunion of fresh wounds, when laid together, and not dressed for eight days, he formed this promising conclusion, That, as according to the common saying, the "blood is the best balsam for a wound," "its own foul matter should be the best balsam for a sore." He resolved not to dress the sores of the surgical wards at shorter periods than five or six days, but that the matter might not run through the bed during that period, he made the nurses gather all their old sponges, and applied to each sore a sponge. Four or five days after a great many gentlemen attended in the wards on the tiptoe of expectation for the further issue of this experiment! each sore, as it was successively opened, was in a horrible condition, "the worms they crept in, and the worms they crept out," and the Doctor was in great disgrace till he discovered the cause. He had given the nurses very strict injunctions about cleansing their sponges, which they very strictly obeyed; but each sponge, after being washed, was laid by the window to dry; it was hatching season with the great flies, who were very glad of the sponges to deposit their eggs in; and when these eggs were laid into the sores, and kept there for some days with all the advantages of such a situation, they did hatch with a vengeance*.

The military surgeon has very frequent occasion to see the *ulcus verminosum* in warm climates, and in much neglected sores; and though these myriads of worms were not actually to corrode nor irritate the ulcer †, yet they are such an indication of its sad neglected condition, that they must immediately be removed, let the accident which produced them be what it will. The sores must be washed clean, and dressed dry, and if worms should continue to be generated, decoctions must be applied of wormwood, rue, or any bitter herbs, or a solution

* Dr. Aitken's vindication of himself may be seen in his *Principles of Surgery*.

† That worms will bite and corrode the flesh is most satisfactorily proved by Thamur in his account of the *Salomonii Vermi*, which wrought much of the stone and marble work in Solomon's Temple.

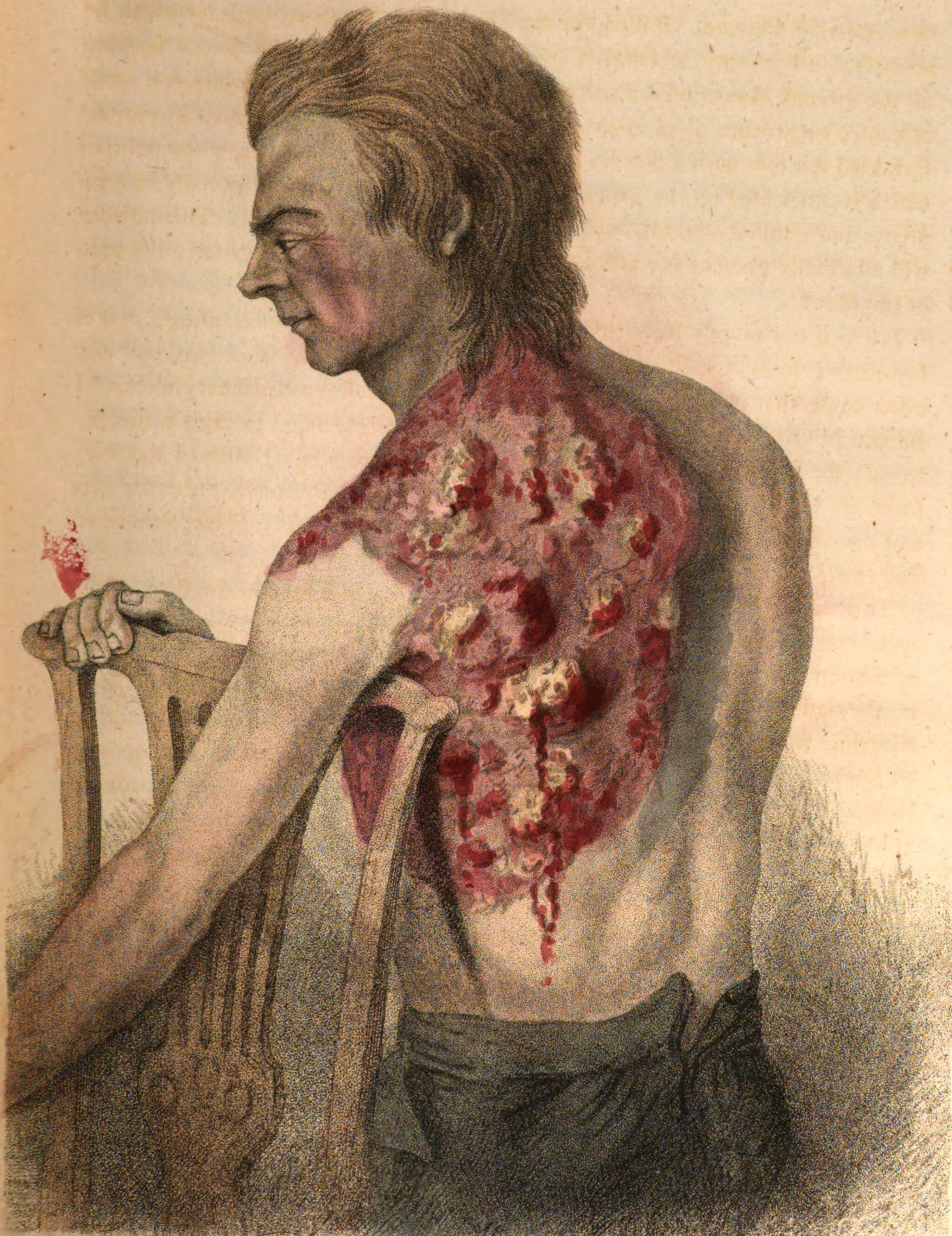
Salomonem cum marmor Parium ad ædificationem templi e remotis partibus conveyi præcepisset, conscientiam prohibitionis legis quæ vetuit altaris ædificandi lapides ferro incidi quæsisse experimentum in vermibus Salomonici quod ars humana nescivit: pullum struthionis in vitreo vase reclusisse, quem cum videret struthio et habere nequiret, naturaliter agnitam artem attentans, in desertum cucurrit rediensque vermiculum tulit cuius sanguine vitrum linivit et confractum est, sicq. fœtum eripuit; quod (ait auctor) videns Salomon hoc experimento eodem genere vermis in incisione durissimi marmoris usus est, &c. No one would think of disputing the fact, but it is natural to wonder how Solomon came by the electrical jar, which he seems to have used in this experiment.

of corrosive sublimate. Bidloo, in the cure of these wormy pustules which he often saw in the camp, and which probably were owing to the men's sleeping on the ground, always used a mercurial wash; and Steenvelt an ointment made of venice turpentine, aloes, mercurius dulcis, and yolks of eggs mixed up: or he sprinkled the sore with a powder made of aloes, myrrh, and nitre, a composition which is often used by the army surgeons on the Continent, especially in gangrenes and gunshot wounds, with extensive caries of the bones. This powder will effectually prevent any accident of this kind, and contribute also to the cure of the sore *.

But it is not merely from this collection of vermin that uncleanness makes formidable sores, for it will spoil the texture of the skin; and (without any other cause that we can perceive,) produce the most extraordinary ulcers. I subjoin M'GILLIVRAY's case as an example the best calculated to explain this position; for his wound was extremely small, the ulcer which followed was very singular, both in extent and appearance, and was finally cured, rather by care and cleanliness than by surgery! Yet what is surgery in this case but cleanliness and care?

This man, who is about fifty years of age, was a serjeant in the sixty-eighth regiment, was landed on the Continent with Lord Moira's army, was in the siege of Nimiguen. When the Waal froze over, so that the French were able to cross it, they attacked the British army, and during the retreat this man was of the covering party, being one of about three hundred who had the care of the baggage. They were suddenly surrounded by three thousand French, who formed a circle, and cut them off from the camp, which was formed in a valley about the distance of two miles; he was standing by his baggage waggon firing, and had fired four or five rounds when he was wounded. He saw no man fall before himself; the last thing he remembered was to have seen an irregular fire upon his small party in all directions; he was sensible of being wounded, but felt no pain; fell forwards upon his face, and lay for a long while, and when his senses began to return, he found his hand lying upon his breast over the wounded part, his hand and clothes bathed in blood. He turned on one side, and

* These powders, as of rhubarb, bark, myrrh, and aloes, &c. when applied to sores or gangrenes, are not only useful by their stimulant powers, but are really the softest applications possible, and the best absorbents of foul matter. The Indians lay their little children in baskets filled with powder made of the barks of trees, where they lie soft and warm, and all moisture and filthiness is absorbed.



J. Bell del.

James Macgregor

The first of these is the fact that the United States is a young nation, and that its history is a history of growth and development. The second is the fact that the United States is a nation of immigrants, and that its history is a history of the struggle for the rights of these immigrants. The third is the fact that the United States is a nation of free men, and that its history is a history of the struggle for the rights of these free men.

The fourth is the fact that the United States is a nation of law, and that its history is a history of the struggle for the rights of these laws. The fifth is the fact that the United States is a nation of progress, and that its history is a history of the struggle for the rights of these progress.

The sixth is the fact that the United States is a nation of peace, and that its history is a history of the struggle for the rights of these peace. The seventh is the fact that the United States is a nation of justice, and that its history is a history of the struggle for the rights of these justice.

perceived himself in the midst of a group of French soldiers, who were looking upon him compassionately ; when he stretched out his hands, they were affected with this sign of life ; they raised him up, and continued supporting him ; one of them put his canteen of spirits to his mouth, and gave him a little, which revived him. As soon as he was able to turn round, he saw his wife (who had also been shot), fallen from the baggage waggon, and lying dead, and their little boy, then about two years old, climbing upon her breast. The soldiers led him up to the spot ; he took the child into his arms, and wrapped it in his plaid, but they soon were sensible that he could not carry the child, and they took it from him ; he pointed to the dead body, and offered them some crowns he had in his purse to bury it. They dug a hole, and were burying his wife, when the alarm having reached the English camp, the French were attacked in their turn, the baggage was retaken, but he and his boy were hurried away, and thrown into a French prison in Nimiguen, where he continued to suffer all kinds of misery for nearly three years.

The ball had entered under the clavicle, and passed out behind ; the great vessels had escaped, but the smaller arteries which were cut bled freely. It was three days before the French surgeon visited him ; he passed a long probe through the wound, from back to breast, and drew after it a large skaine of cotton-wick, in hopes of entangling and drawing out any pieces of the coat or shirt, or shattered pieces of bone. This ball had entered beneath the clavicle, and passed out beneath the scapula : it had entered when he was stooping forward firing his piece ; had crossed the thorax, which is very narrow at its upper part, raked all along under the scapula, and had come out pretty low in the back ; not a bone was broken, nor was there any wound of the lungs, for he never had the slightest impediment in breathing, nor did he ever cough up blood. After this first visit he was so entirely neglected by the French surgeon, that he was obliged to have recourse to one of his fellow-prisoners to wash the wound sometimes with a bit of sponge ; he scraped his shirt into lint, and applied a little daily to each end of it. The miseries which he endured in various prisons for two years and eight months, brought the wounded part into the wretched condition in which it was when I saw it. In winter he suffered extreme cold ; he lived on bread and water only ; and of the black bread which he got, his allowance was but one pound a-day ; no surgery, no opportunity of cleanliness, no care. After his health had been injured by cold and hunger, the heat of summer,

in a close wooded country, corrupted the skin, and covered his shoulder with this terrible ulcer; half a year had elapsed from the time of his being wounded before the surrounding parts began to degenerate into this very singular sore.

The sore never appeared to heal during the heat of summer. The skin all around both wounds (and to great extent), grew livid and very dark coloured, then broke out into white pimples; the pimples afterwards burst, and discharged imperfectly a white viscid matter; two or three pimples ran together into one, and formed a sore; then a scab covered that sore, confined the matter, made the inflammation spread, and comprehended other pustules; these, again, were in their turn closed up, the skin was undermined by successive pustules uniting; from pustules they became abscesses, and from trivial abscesses, deep inflamed sores. During the progress of this ulcer, the foetor of the matter was such, that the whole prison was infected with it. The poor man could indeed get his sore washed with water; but no diligence could mend his condition; the foetor was quite sickening and oppressive to himself; the ulcer spread first round the wound in the breast, then round the back over the whole skin, which covers the shoulder joint, then over the scapula, then up the neck, and down the whole side; the skin became remarkably livid, everywhere greatly thickened: in one place, hard and callous, in another, soft and boggy, as if there were matter under it, although there was none; in one place an abscess was forming, near that was another abscess entirely ripe, and close to that another burst, and discharging yellow, very viscid, and mucous-like pus, which undermined and destroyed the skin. These various abscesses, in all stages of progress (like ripe and unripe fruit on one branch), worked, not superficially, but deeply among the cellular substance, and the whole skin was puffed up; you might have felt the matter in these abscesses fully a month before they burst; and while they were working under the skin, the veins were eroded, and the blood burst out, sometimes so freely as to bleed like the vein of the arm. He frequently bled to the amount of two pounds at once, and much of the blood was, at the same time, driven under the skin, by which there was mixed with the dark red of this chronic inflammation the blackness of echymosis; and along with the hardness and callosity of inflamed skin, there was from point to point a pulpy feeling, as if, of anasarca, echymosis, and abscess, united. There were besides two or three flat, thrombus-like tumours, fully three inches in diameter, which when pricked with the lancet emitted only blood.

This disease being merely a corruption of the skin, arising at first from his dirty

and miserable situation, and perpetuated by one little abscess after another undermining and destroying the skin; the plan which I laid down for curing him was this: I ordered him the warm bath, gave him a purge, and put him on good diet, with a little wine; I directed the warm bath to be repeated three times a week, to support a soft and pleasant state of the skin; and a fomentation of camomile decoction, crude sal-ammoniac, and a little spirits to animate the skin, was applied to the shoulder for one hour every morning and evening. The chief point was to manage the little abscesses and thrombuses so as to prevent their undermining the skin. I opened two or three with the knife; and taught his dresser how to cut each irregular abscess as it formed, down to the bottom, with a direct incision, till he reached the sound flesh. Each abscess was accordingly cut before it was fully formed, with the knife, if large (as some of them were three inches long), and with the lancet, if small. The incisions were not made in what may properly be called an abscess, but through a piece of diseased, spongy, and suppurating skin. The matter and blood were thus prevented from undermining the skin; the inflammation was drawn away from the swelled parts towards those occasional incisions, which became then, as it were, the centres to their own proportion of the disease, and each scarification was filled with a strong mercurial ointment, rubbed in very thoroughly with a hair pencil. The consequence was, that each incision being stimulated into a right and healthy suppuration, was made to relieve the adjoining skin before it was permitted to heal. By these practices, varied according to the circumstances, this strange disease was entirely cured; it had continued two years and nine months; but by persevering in this plan, especially in respect of the scarification, (which was indeed a daily and severe operation), he recovered perfectly in six weeks. Even the dark colour of the skin almost disappeared, and it became soft, pliable, and clean.

Excepting such ulcers as these which I have described, none, I believe, are entirely local; every great ulcerated wound becomes so from a fault in the constitution, not from the ill disposition of the particular part. This at least is the case in every dangerous ulcer; and this observation very naturally occurs to me, when I proceed, next, to speak of the HOSPITAL SORE, which I would not regard as a mere ulcer, to be treated like other common ulcers, but as a general affection of the system, a mortal disease; for when it rages in a great hospital it is like a plague; few who are seized with it can escape.

There is no hospital, however small, airy, or well regulated, where this epidemic ulcer is not to be found at times; and then no operation dare be performed! every cure stands still! every wound becomes a sore, and every sore is apt to run into gangrene: but in great hospitals especially, it prevails at all times, and is a real gangrene; it has been named the Hospital Gangrene; and such were its ravages in the Hotel Dieu of Paris (that great storehouse of corruption and disease), that the surgeons did not dare to call it by its true name; they called it the rottenness, foulness, sloughing of the sore! the word, hospital gangrene, they durst not pronounce! for it sounded like a death-bell*; at the hearing of that ominous word, the patients gave themselves up for lost. In the Hotel Dieu this gangrene raged without intermission for two hundred years, till, of late, under the new government of France, the hospital has been reformed. "A young surgeon (says an ancient French author) who is bred in the Hotel Dieu, may learn the various forms of incisions, operations too, and the manner of dressing wounds; but the way of curing wounds he cannot learn. Every patient he takes in hand (do what he will) must die of gangrene." Nothing, perhaps, will contribute so much to your understanding this disease, as a plain description of it in the form of an individual case.

Joiner, a boy belonging to the Triumph, whose ulcer I have drawn, received but a very slight and superficial wound, and for some time after the battle he continued in health, and the wound healed rapidly. But while it was to all appearance florid and healthy, with no threatening of ulceration, the boy in full spirits and strength, walking about on crutches, guilty of no irregularity, it began to look ill; a sure presage of some change of health.

There came on a cough, with symptoms of a common cold, which he imputed to his bed being placed near a door, lately open and now shut, but not walled up; then his health failed, his spirits became quite oppressed; he had occasional attacks of fever, frequent vomiting, and a continual loathing of food. With these slight and seemingly unimportant symptoms (but the tendency of

* La Motte says, "Mortification ce qu'on appelle POURITEUR a L'Hotel Dieu de Paris, laquelle survient et accompagne presque toutes les playes qui sont traitte dans cette hospital," p. 330. And the disease was not named, "dans le crainte d'inquieter ces blesez qui croiroient etre perdue des que l'on appelleroit cette pourriture, GANGRENE."



JOINER.

A: BOY of the TRIUMPH.

such symptoms when they appear in a foul hospital is easily understood), his fore, which was no bigger than the palm of the hand, became in two days as big as the crown of a hat, in one week it grew as large as represented in the drawing. The whole skin of the thigh was destroyed, the muscles were stripped of skin and fascia from the hip to the knee, the trochanter was almost laid bare, the hamstring muscles exposed to a considerable extent, and all the muscles of the thigh dissected in a manner which no drawing can express.

While these ulcers made their dreadful progress in any of the wounded, I could observe them pass through the several stages, first of inflammation, then of insensibility and gangrene, and then of renewed pain and sensibility. First, when the health is affected, the patient languishes for a few days, and the sore inflames; then come vomitings, diarrhoea, and a distinct fever, and the disease seizes plainly upon the wounded part. In its first stage the wound swells, the skin retracts, wastes, has a dark erysipelatous redness verging to black, the cellular membrane is melted down into a foetid mucus, and the fascia is exposed. But in the second stage, the fascia and skin unable to bear their inflammation, and deprived of mutual support, become black, foetid, soft, and fall into perfect gangrene; yet there are no vesicles, and the mortification is confined within the cavity of the sore. This is the stage of insensibility; the parts within are covered and defended with a perfect slough, which no medicine can penetrate, on which no applications can make any impression; and stimulants are used, without pain, of such a hot and fiery nature, as none but dead parts could resist: But when these sloughs open in the natural course of the disease, and the living parts are exposed, and the medicines begin to make an impression, it is imagined that these applications are restoring life and energy to parts which, before they were applied, seemed entirely dead! It is under this impression, that stimulants are continued of a strength which parts thus inflamed cannot bear; the disease is aggravated by them, and the cries from all sides are such as would melt the most rugged nature.

In the third stage, this gangrene ceases, the sloughs fall off, the muscles become exposed, the part assumes once more the appearance of a common sore, but fearfully enlarged; a high and glossy red, and a smooth, shining, uninterrupted surface, mark the continuance of the inflammation and disease; but if the sores are to do well, it is known by a rough, granulating, surface, somewhat dry, and of a paler colour.

If the patient is to die, the gangrene or wasting of the cellular sheaths proceeds; the skin first sloughs off; then the fascia is destroyed; those divisions and lamellæ of the fascia, which dive betwixt the muscles to enclose, protect, and nourish them, are next affected; the matter continues slimy and thick, and in prodigious quantities; the muscles are divided from each other more and more. In many who suffered under the disease at the same time with Joiner (the boy above mentioned), you could have laid your hand edgeways betwixt the several muscles of the thigh. Then the vomiting, diarrhœa, and nervous symptoms increase, the pain is dreadful; the cries of the sufferers are the same in the night as in the day-time; they are exhausted in the course of a week, and die: or if they survive, and the ulcers continue to eat down and disjoin the muscles, the great vessels are at last exposed and eroded, and they bleed to death. Thus a lad of the name of Handling, who had at the first but a slight wound in the thigh, had the cellular membrane, in the course of a few days so destroyed, that you could put your clenched fist into the hip, and could lay the hand sideways betwixt any two muscles of the thigh. You could have counted each muscle, as in a dissection, from the tuber ischii to the ham. The branches of the Profunda Femoris first gave way, then the Sciatic vessels; for three nights he lost two or three pounds of blood each night; it would have been almost cruel to stop the hæmorrhagy, had it been possible, so very desperate was his situation; on the fourth day he died. I hope and believe that these scenes have made a lasting impression on the few who witnessed them.

These are the forms which this disease assumes when it attacks an amputated stump, a broad and open wound, a laceration of the skin, or any surface which is apt to become a flat fore. But when it attacks a narrow wound, as a bullet wound, a wound with any pointed instrument, even the prick of a nail in the finger, it assumes at once the form of an Erysipelatous Gangrene (Erysipelas Gangrenosa); and when this disease prevails in the hospital, you may see even a NURSE, from some slight hurt in the hand, which at another time could have done no harm, have one day a swelling of the wound, on the next an erysipelas of the arm, with dreadful pain and low fever; on the third day the arm will become livid, and covered with vesicles, and in two days more fall into gangrene; the woman oppressed in the mean while with hiccup, low delirium, and other symptoms of approaching death.

The wounds which are most apt to be seized with this hospital gangrene,

are those which are flat and open, because in them much of the skin has been torn away. Tucker, a boy also belonging to the *Triumph*, who lay in the bed next to Joiner, had like him received a superficial and open wound, or a scratch rather, upon the loins from a splinter of wood. This dreadful infection seized also upon his wound, and the ulcer extended over the loins, over both buttocks, and part of both thighs; he could lie only on his belly, and, like Joiner, cried in a most lamentable manner. A flap of skin torn down by splinters from the arm or thigh is sure to run into this kind of gangrene. James Buck, a sailor, was wounded with a splinter of wood, which tore away a flap of skin from the fore part of the thigh, cutting it as clean as if it had been done by the surgical knife. Two small arteries required to be tied, a venous oozing from the lacerated Saphena vein continued for two days; but this ceased, his wound contracted fast; he was able to go upon crutches, and was allowed to indulge himself abroad. You know well that a sailor's indulgences, after long confinement, are of a coarse kind for a sick man. We found that he had been often drunk, was frequently revelling all night in the streets, and when day light approached he scrambled over the hospital wall, or through the ditch full of mud*. Frequent debauches, and the cold of winter, exposed him to the infection of the house; he was weakened, fell sick, the hospital fore spread over his thigh to a most dreadful degree; but wine and opiates, and careful living, brought him right again; and he was one of the few who had a prospect, when I left him, of recovering from the disease.

ATTWOOD, a corporal of marines, was wounded by a great splinter of wood, which struck him in the arm, so obliquely, that without breaking the bone, hurting the muscles, or wounding any great vessel, it tore down a long flap of skin, from the top of the arm to the elbow, it was not ruffled and furled up, but left adhering only by its lower end, and separated so clean, that it hung from the elbow like a flat strap of leather, and there could be no doubt about cutting it away. Such a wound is, by a judicious surgeon, sent into an hospital with great reluctance; the man is a sure victim to the hospital gangrene; he goes like a sheep

* At Yarmouth, as in other military hospitals, when they wanted to steal out and get drunk, they had two general methods, the wet and the dry; the wet when they went through the ditch, and the dry when they burrowed through the sand, and so got under the pallisado. In the Yarmouth hospital centries were placed, one to guard the holes, and another to guard the ditch; however he had the most difficult duty who watched the ditch, for nothing of them but their heads were above the mud; and unless he heard them puddling and snuffling, he had no chance of preventing the enterprise. These were the men wounded in the Dutch and English fleets on the 11th of October 1798.

to the slaughter. Yet, for a month nearly, this wound did well; when the man, beginning to find himself too well, got abroad, was drunk every night, and rioting in the streets, and was exposed during intoxication to extreme cold, two depressing powers, which, in a particular manner, subject the system to the hospital gangrene. It may easily be imagined, that a man living in this idle way used many dangerous freedoms with his arm, so that it was very ready to inflame as soon as his general system began to fail. The hospital sore is usually preceded by a degree of fever; the health languishes, the appetite decreases, the patient rejects his food, the tongue becomes very foul, with thirst, and a small, weak, quick pulse: there is a latent fever, or tendency to fever, and very generally a diarrhoea ensues. Attwood being seized with these symptoms, his arm swelled, the edges of the wound rose much above the level, the whole skin became black, and sloughed off in flakes, the fascia fell off together with the skin, the muscles wasted so in a few days that nothing was left but the bone, covered, as it were, with a sort of moss, or efflorescence, of clear, red granulations; the one half of the arm is now lost; and though the ulcer should be cured, which I question very much, the arm will be useless for life.

Thus we find superficial ulcers, splinter wounds, the flat surfaces of stumps, or any open surface, the most apt to be seized with the hospital gangrene; but when the disease rages, nothing can resist it. One of the ugliest ulcers among those who survived the disease, proceeded from a penetrating wound. It was in one Sherridan, a seaman of the *Belliqueux*. There was in the wound of his arm, unquestionably, no ball nor splinter of shot, and therefore there was every reason to believe the wound to have been made by the point of some long shaft-like splinter, which had immediately dropped out again. The wound was on the outside and middle of the arm, somewhat ragged, and very deep, as if the splinter had passed by the side of the bone. Mr. Hill, the surgeon of his ship, held a consultation upon the case with Mr. Broomly of the *Monmouth*; for though the arm was not greatly swelled, yet the wound was exceedingly narrow, the probe passed inwards to a great depth, and there seemed danger of a collection of matter. The opening of the wound was very narrow, the circle of it very red and turgid, the matter sanious, and the arm, though not much swelled, was in great pain. The wound was, very properly, dilated; but as the splinter had almost transfixed the arm, perhaps it would have been more fortunate if the probe had been introduced, and cut upon, a counter open-

ing made, and a seton passed through that counter opening ; and this, if to be done at all, should have been done at the first ; for in men who are to be thrown into a foul hospital, incisions are particularly apt to go wrong ; and I think I have observed, that the stimulus of a seton, together with the smallness of the opening which the seton requires, keeps the wound in better condition than the dilating it with the knife. While this man remained at sick-quarters (i. e. at country lodgings), his arm healed, and it even continued well for some time after he was brought into the hospital ; but it was not long before he lost his health, the fore inflamed, and in a few days the hospital gangrene carried away all the skin and muscles, from the shoulder down to the bellies of the supinator muscles ; the fore-arm, especially at the elbow, swelled ; the arm wasted, and the flesh was so destroyed by this horrible ulcer, that when the sloughing was over, nothing seemed to be left of the arm except the bone, covered with a velvet-like surface of shining red flesh, like that represented in Joiner's hip.

A stump which has not adhered is a flat wound, peculiarly apt to be seized with this dreadful disorder ; and in wards where the disease prevails, amputation should not be performed. It is almost impossible to heal the stump ; it sloughs, ulcerates, shrinks, becomes pyramidal ; and to the very last moment of its healing, and even when the scar seems formed, or is about to be formed, the patient is liable to rigors, slight vomiting, a quick and irritable pulse ; and then, in the course of a few days, the stump is burst open by inflammation, and spreads itself into a broader surface than even when the limb was cut off. In one day I saw three stumps burst open in this manner, each of which was so nearly cicatrized, that you could have covered the small spot that was left unhealed with the tip of the little finger. One of the men to whom this happened was Thomas Crouch, whose stump is drawn, in the Chapter on Diseased Stumps. His arm was struck by a great shot, and left hanging by one rag of flesh ; the bone was sadly shattered ; the rag of flesh which held the arm was cut off ; the surgeon thrust his finger into the hollow of the mashed and lacerated stump, and the bone was found to be split and shattered a considerable way up. The arm was amputated three or four inches above the wound ; and it was cured in six weeks ; not the breadth of a sixpence being left unhealed. He had been often seen in the streets drunk : by such irregularities he had so debilitated his system, as to expose himself to the hospital sore ; his stump gradually opened wider and wider ; the flesh shrunk from the bone, the bone lay uncovered

in the hollow of the stump, and began to exfoliate. The drawing is taken at the time of the fore's being expanded to a surface much broader than at first, because now, in addition to the natural size of the parts, the whole circle or border of the stump was greatly inflamed and swelled. The danger of this inflammation and ulcer of the stump is extreme; the least evil that can ensue from it, is a great wasting of substance, an exfoliation of the bone, and a conical stump: but we are often disappointed even of this imperfect cure, viz. in the form of a conical stump; for it happens in an ulcerating stump, as in other sores, that the greater arteries are eroded, and then the patient almost inevitably dies.

This you perceive, Gentlemen, is a very dreadful disease; it is indeed a study in itself; and therefore the observations I have here to lay before you must be very limited.

We have no reason to consider this as a local disease, nor can almost any ulcer be considered as entirely local. We see parts injured in every possible way; yet no injury of the parts produces a permanent sore; we see parts ruined in their texture by contusion of machinery, or by stones, beams of wood, &c. falling upon them; we see parts entirely killed by the contusion of shot; we see them irritated by spoiled bones and balls, and splinters buried in the flesh; we see wounds teased with tents, caustics, catheterics, or corrosive and irritating medicines, without ulcer being produced; we may do what we will to the part, without producing ulcer, if we hurt the part only. While there is no predisposition or general disease our greatest imprudencies produce but superficial sores, the farthest from the nature of ulcers; there is, on the contrary, when parts are irritated and vexed (at least in a healthy constitution), a perpetual resistance and tendency to heal; nay, when it becomes our duty to establish a discharge, a perpetual ulcer can hardly be maintained; it is done with difficulty, even by beggars and gypsies, more cunning in this respect than surgeons. Excepting that habitual ulcer which arises from the dependent posture of the lower extremity, all ulcers, great and small, have their cause in the general constitution, not in the part; it were, perhaps, out of place to add here, that all great inflammations are founded in weakness; for I am now speaking rather of the effects of inflammation, viz. ulcer and gangrene; than of inflammation itself. Inflammation itself may or may not consist in debility; but it is surely from debility, or exhausted excitability, that a part sinks under the disease; for if, in the case of a wound, the system or the part have sufficient strength to support the action, the part will suppurate, granulate, and heal;

but if the system be irritable and weak in an extreme degree, the part is quickly exhausted of its excitability ; it is no longer able to bear the action ; the inflammation overpowers it, and it sinks under the disease.

There are various ways in which the excitability of an inflamed part may be thus suddenly exhausted, so that it shall fall into ulcer or gangrene. When, for example, the actions of a part are long suspended by cold, moderate heat is a stimulus too high for it to bear ; the parts, upon being heated, seem to fall into immediate gangrene, preceded by a state of inflammation, too short and transient, indeed, to be much observed ; yet I never knew a frost-bitten limb fall into gangrene without previous inflammation and great pain. The wound may be a poisoned wound, of a nature such as to exhaust the part in a moment ; and yet in this case, though the part does grow very suddenly black, there is a moment of high excitement, and excruciating pain. The system, also, may have laboured long under a state of habitual weakness, so as easily to lose its remaining excitability ; and accordingly, when we make punctures in a dropical leg, they hardly inflame before they fall into gangrene ; and a man who is hurt in the spinal marrow, if he has a wound at the same time in the lower extremities, immediately suffers a low and livid inflammation in the part, which falls presently into a gangrenous sore. A man may be healthy when he receives a wound, and the system being full of vigour, the parts may be able to support their inflammation ; but the moment that he loses his health, the excitability of the part is liable to be borne down by that degree of inflammation which it sustained while the system was healthy, but which it is now no longer able to support. The parts sink under the action ; that action is no more violent than it was at first, but the part is less able to endure it ; and thus, as soon as any new sickness shows itself, and especially when the system is attacked with this hospital fever, the wound becomes livid and gangrenous, and takes the appearance of a gangrene from cold, of a poisoned wound, or of that kind of gangrenous ulcer which is produced by scarifications, or slight wounds in a dropical or paralytic limb.

These are the consequences, not of that infection only which we call the Hospital Gangrene, but of every debilitating cause. Drunkenness and debauchery, stomach complaints, vomiting, diarrhoea, low spirits, the return of an old intermittent fever, the infection of dysentery, any debilitating cause, will produce a change in the appearance of a wound. But this infection of the hos-

pital is the most irresistible of all. The moment that a man is struck with it, you may observe him become pale, fallow, languid, low-spirited, with a heavy eye, a confused head, a loathing of food, a fretful pulse, and, in short, a universal disorder, which he can neither account for nor describe; and whether this disease appear first in the system, or in the part wounded, its progress is the same. When I have observed in any case the sore to be first affected, I have noted it as a sure symptom of the approaching disorder of the whole system; or when the system was first affected, I have marked that as a sure presage of the sad change that was soon to appear in the sore. He must, indeed, be very ignorant who disputes this hospital sore's being a general disease of the system; he must have observed very little, who does not know it to be absolutely an infection. To what other cause can it be ascribed? To a scorbutic and bad habit of body? Surely not; for the boys of the ship, who run about continually, and from their spirits and exercise are always in health, are the first affected with hospital sore: but those chiefly subject to the scurvy, are the landsmen, who are unhappy in a sea life, impressed men who have been torn from their friends, or lazy skulkers, who never move but to the sound of the boatswain's whistle. Neither can we attribute it to the unhealthy state of the crew of a particular ship; for the wounded of such ship are unavoidably dispersed; some are at sick-quarters, and they get well; some are carried into the hospital, and they become diseased; and sometimes, when those hospital patients are carried out again to sick-quarters, they recover their former health. Thus we see this disease confined within the walls of an hospital; nor does it always extend farther than a single ward. In Yarmouth, the English seamen who were wounded on the 11th October were divided from three hundred wounded men of the Dutch by a wall only; the great wards were on the opposite sides of the partition under one roof; on the one side of that partition we operated on men and boys, opened sinuses, or searched for balls or pieces of shot, as freely as in the most healthy hospital, or in sick-quarters; not a sore was to be seen there, except such as were the inevitable consequence of gunshot wounds, with carious bones. But on the other side of the partition-wall were such sores as are seldom to be seen, prohibiting all operations even the most trivial.

Indeed, from all that I ever could observe, the vulgar expression of the tainted air of an hospital, is not incorrect. This ulcer and gangrene is, in an hospital of wounded men, what puerperal fever is in a lying-in ward; it is an infection to

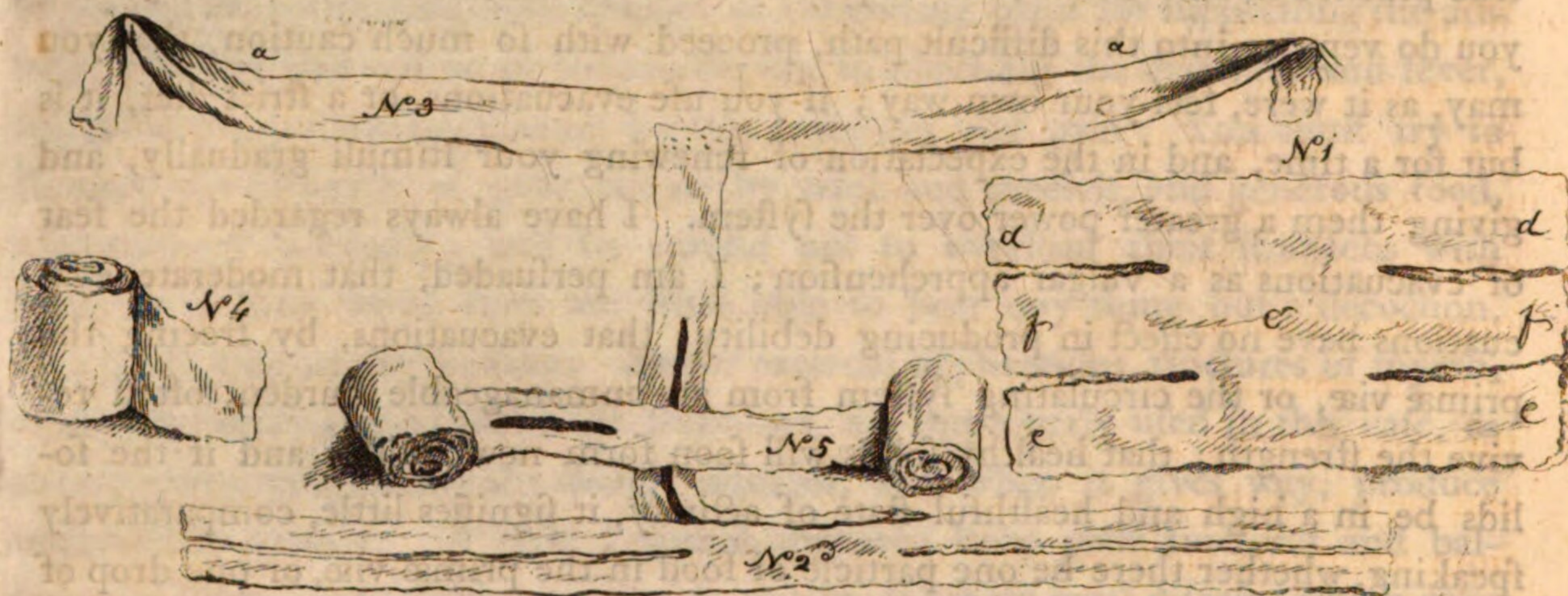
which all are equally exposed ; but it is resisted by health and strength, and favoured by weakness or disease. Excesses, drunkennesses, cold, and every cause of weakness, expose the constitution to its attack. If diarrhoea, fever, dysentery, or an old intermittent, or even a common cold, attack a wounded man who lies in an unhealthy hospital, the first febrile symptoms are immediately followed by this terrible disease. Though we often mistake these debilitating powers for principal, I suspect that they are but predisposing causes, and that the disease of the hospital, like a peculiar typhus, or the ulcerated fore throat, is still the same. What, then, is the surgeon to do ? Is he to try experiments with ointments and plasters, while men are dying around him ? Is he to seek for washes or dressings to cure such a disease as this ? Is he to expend butts of wine, contending, as it were, against the elements ? No ! Let him bear this always in mind, that no dressings have ever been found to stop this ulcer ; that no quantities of wine or bark which a man can bear, have ever retarded this gangrene ; let him bear in mind, that this is a hospital disease ; that without the circle of the infected walls the men are safe ; let him, therefore, hurry them out of this house of death ; let him change the wards, let him take possession of some empty house, and so carry his patients into good air ; let him lay them in a school-room, a church, on a dunghill, or in a stable (like Paree's gangrened soldier), let him carry them anywhere but to their graves. No expence should be spared ; for these are men who have entitled themselves to care, by every claim which men can have ; and no one will dare to check the surgeon in these his most important duties. You are not sent out with only the amputation-knife in your hands ; you are appointed to save the lives of your sailors or soldiers by all possible means : You are to conduct yourselves not like mere mechanical surgeons, like men capable only of doing over again what they have seen or heard described in schools, nor like men without sense, reflection, prudence, or those free and manly conceptions which your distinguished situation and new and various duties require : You would willingly expend your own fortune in such a cause,—then do not grudge to employ the revenue of the state, for it is employing and not abusing it ! this is not profusion, but the wisest and best economy : if in the course of a few weeks sixty men die of the disease in your hospital, government has lost a sum which would trebly buy your hospital itself ! The gross value of so many men in money, as they are reckoned on the muster books, being full fifteen thousand pounds.

Till some change of situation be accomplished, little can be done for men labouring under this plague; but when the disease first breaks out and rages, and while you are meditating some change, or concerting plans for suppressing the disease, you will find opium of infinite service in checking the diarrhoea and fever, for these are greatly aggravated by the irritation and pain: You must try to support the strength of your people by wine and cordials, and generous food, administered sparingly; and be careful not to overload their stomachs with bark, at a time when they are little able to bear any thing but a decoction, or a small dose of the powder. As for external applications, tinctures of myrrh, aloes, and other drugs, still more stimulant, are improperly used in this case, as they have no effect while the slough remains, and when it gives way, produce unspeakable torture. Of these I cannot approve; keep your tinctures and balsams for fistulas, and your torturing stimulants for those local diseases which may be cured by them; but this not being a local disease cannot be cured by local applications, and therefore the mildest are the best; as, for instance, a solution of sal-saturni, which is a gentle astringent.

The hospital sore is a general disease in which your whole attention is to be directed to the state of the system, and that is such as will not be easily set to rights. But there is one general fact which is very interesting: we cannot but observe how much and how suddenly the powers of the living system rise after being depressed; we cannot but remark how after a short fever the system acts with uncommon vigour, how every disease disappears before the fever, and how the patient thrives after it is gone. We also see plainly the most wonderful effects, from that tumult of the system which is produced by hyosciamus, belladonna, digitalis, cicuta, mercury, and other violent drugs. Even a violent vomit excites the absorbents, and sets the whole system to work. Surely it must be from plunging the system into a sudden state of debility that it regains its elasticity (if I may express it so), or recovers its susceptibility with regard to the ordinary powers of life: I know of no other way by which we can account for the singularly good effect of evacuations in many diseases. It is on this ground that in the beginning of all fevers I still approve the old practice of vomits, purges, and abstinence, by which I often see the system recovered from its oppression, and restored to that freedom of action, and that aptitude for stimuli, upon which much of the cure depends, and by which the system is prepared, as it were, for the action of those powers, as opium, bark, wine, and mild, but nourishing diet, upon

which we are to trust to for accomplishing the cure. I think that in this hospital ulcer I have seen such practice useful; but I am so undecided with regard to the true practice in this disease, that I speak with diffidence, and would have you, if you do venture into this difficult path, proceed with so much caution, that you may, as it were, feel your own way; if you use evacuations, or a strict diet, it is but for a time, and in the expectation of renewing your stimuli gradually, and giving them a greater power over the system. I have always regarded the fear of evacuations as a vulgar apprehension; I am persuaded, that moderate evacuations have no effect in producing debility; that evacuations, by freeing the primæ viæ, or the circulating system from an unmanageable burden, often revive the strength; that healthy solids will soon form new fluids; and if the solids be in a high and healthful state of activity, it signifies little, comparatively speaking, whether there be one particle of food in the primæ viæ, or one drop of blood in the arteries more than is barely necessary to preserve them in action.

I began this discourse with the design of explaining to you only in a very general way the ordinary duties of a surgeon: and if I have been induced to speak more fully on some interesting points too little regarded in the common books of surgery; it is because in these duties there is more usefulness than show; they are daily cares more honourable in my mind than bloody incisions! Perhaps, the forest reproach against the authors of such books would be to say, that they have not understood those duties; but surely the greatest misfortune that could befall you, as young men, would be the learning to neglect them. If the directions which I have laid down should enable you to go your rounds in the hospital with a quicker eye, and clearer understanding of the cases that are committed to your care; and a more perfect command of the ordinary remedies, I shall be very highly gratified: and if you can once bring yourselves to like a discourse on such ordinary concerns as these, better than one which is more argumentative or learned, I shall think it the strongest proof of your good sense, and the most perfect assurance that you will become good and useful surgeons.



DISCOURSE IV.

ON BANDAGES.

IN my last discourse, Gentlemen, I ventured to say, “ That while we are improved in the great points of surgery, we are gone backwards in all those nice and delicate attentions, on which so much depends in the cure of wounds.” And while speaking of suppurations and fistulas, and the lax swelling of a wounded or broken limb, you could not but observe that I noticed many uses of bandage which you must have lamented to find so imperfectly explained in books. These things, however, should not be neglected; they are least of all to be neglected by one who thinks an attention to the common and humble duties of the profession more commendable, more becoming, more like good sense and sound judgment, than a passion for bloody operations and extraordinary cures.

With the design of this discourse, you are therefore already in some degree acquainted; and I trust, that I shall prove the subject to be particularly worthy of your attention; for a bandage is not merely useful in tying up a wound, but in accomplishing many important operations in surgery, more interesting, indeed, than those

which are done with the knife. In wounds, in abscesses, in fistulas, in any general disease of a limb, bandaging is the chief operation of surgery; what the knife cures, it partly destroys; what the bandage cures, it saves.

1st, Although in recent wounds, it is with plasters and futures that we unite the parts point to point, yet it is with the bandage that we support the limb, preserve the parts in continual and perfect contact with each other, and prevent any strain upon the futures with which the parts are immediately joined, and we often unite parts by the bandage alone. The Uniting Bandage has been long known by that name. But it is particularly to be observed, that in gunshot wounds, and other bruised wounds, though it would be imprudent to sew the parts, since it is impossible that they should altogether unite, yet the gentle and general support which we give by a compress and bandage, prevents them from separating far from each other, unites the deep parts early, and lessens the extent of that surface which must naturally fall into suppuration.

2dly, Although in the hæmorrhagy of amputation, or in any regular piece of surgery, we trust to the needle alone; in the hæmorrhagy of wounds, we cannot always find the artery; we dare not always cut the parts, for fear of greater dangers; we are often alarmed with bleedings from uncertain vessels, or from members of vessels, or from veins as well as arteries: these are hæmorrhagies to be suppressed by the compress, which compress, or (even the sponge itself), is but an instrument of compression, serving to give the bandage its perfect effect. Frequently, in bleedings near the groin, or the arm-pit, in the angle of the jaw, wherever the bleeding is rapid, the vessels uncertain, the cavity deep, and the blood not to be commanded by a tourniquet, and where the circumstances forbid a deliberate and sure operation, we trust to compress and bandage alone.

Bandage is very powerful in suppressing bleeding. At one period of surgery it took place of every other method; and that was not in times of ignorance, but long after the discovery of the needle; not among unskilful men only, but among the best surgeons in France; or in other words, this was practised very frequently by the best surgeons in the world, not only in the times of good surgery, but by the very men who made surgery what it is. If a compress be neatly put upon the bleeding arteries, if there be a bone to resist the compress, or even if the soft parts be firm below, and the bandage be well rolled, the patient is almost secure. But such a roller must be rolled smoothly from the very extremity of the fingers or toes; the member must be thoroughly supported in

all its lower parts, that it may bear the pressure above. It is partial stricture only that does harm, creates intolerable pain and anxiety, or brings on gangrene. Hæmorrhagy requires a very powerful compression, which must therefore be very general, and must be made very cunningly and skilfully, to be either supportable or safe; it must not be made only over the bleeding arteries, which is all that the surgeon thinks of in general, nor must it be begun at that part where it is particularly required; the bandaging, for example, by which a wounded artery at the bending of the fore-arm may be cured, must be begun at the very tips of the fingers; each individual finger must be rolled; the roller must be continued over the hand, with the greatest attention to leave not a single point unsupported, nor subject to strangulation. It must be rolled carefully and firmly upwards along the fore-arm; and thus the whole of the limb will be supported against that pressure which is made, particularly upon the wounded part. When thus rightly applied, the firmer the bandage is, the less apt it is to be attended with pain or danger. Gangrene is, you may easily perceive, the effect, not of a firm bandage because it is firm, but because it is partial, and strangles some single point of the limb.

From these considerations, we understand why surgeons failed in the cure of aneurisms, notwithstanding their curious contrivances of plates, and screws, and springs, and cushions; they were too curious, all their care was to make the pressure upon some single point of the limb; and all the fault of their instruments was this partial pressure. We also perceive how a beggar is able by the help of a roller merely, to waste his limb, and squeeze together the very bones*. We know, that by a compress and bandage thus applied, we can with certainty not only stop a bleeding artery, as was often done by the older surgeons, by lay-

* The proof that these villains make their ulcers, and destroy their limbs, by secret methods of their own, is, that no surgeon ever saw such diseases except in beggars; nor is he well able to explain how such diseases, ulcers, distortions, and swellings are produced; he could not, all at once, promise to make those diseases which they produce with very little suffering. The surgeon himself, though well skilled in his profession, would need to study how to swell the joints, waste the bones, blow up the parts, as the scrotum, or knee, or head, with wind, how to produce perpetual ulcers of all horrible forms, how to destroy the limbs by compression, how to produce sore eyes, perpetual vomitings of blood, passing of stones from the urethra, enormous flatulent swellings of the stomach. These, and all kinds of diseases (except serious or distressing ones), beggars know how to produce; and this hereditary craft of the gipsy tribe, is not quite unworthy the attention of medical men.

ing a compress within the wound, but we may even obliterate the canal of an artery, by a compress laid upon the outside of the limb.

3dly, In ABSCESSSES, where matter is working downwards along the limb (seeking out, as it were, the weak parts), undermining the skin and wasting it, insulating and furrounding the muscles, and penetrating to the bones, the bandage does every thing *. The expelling bandage, the propelling bandage, the defensive bandage, were among the names which the older surgeons gave to the roller when it was applied for these particular purposes; and these are properties of the roller which should not be forgotten. It is obvious, that of all bandages the simple roller is the best fitted for a diseased limb; but the moment you begin to apply this simple bandage, you will meet with unexpected difficulties; you will feel the necessity of use and practice towards rolling a limb with neatness and perfect effect; you will find yourselves awkward at first, and would almost believe, that a simple roller could never be made a perfect support to a diseased joint; you will perceive your bandages to be irregular from the first, and they will be slackened in a few hours. Practice will convince you, that the firmness and neatness of a bandage depends altogether upon these two points, first, upon the TURNS succeeding each other in a regular proportion; and, secondly, upon making REVERSES, wherever you find any slackness likely to arise, from the varying form of the limb. Thus, in rolling from the foot to the ankle, leg and knee, you must take care, first, that the turns, or, as the French call them, Dolloires, of the roller † lie over one another by just one third of the breadth of the bandage; and, secondly, that at every difficult part, as over a joint, you turn the roller in your hand, make an angle, and lay the roller upon the limb with the opposite flat side towards it; you must turn the bandage so as to reverse it, making what the French call a Renversée of the roller, at the ankle, at the calf of the leg, at the knee ‡; wherever, upon making a turn of the roller, you perceive that it will fall slack, you make a REVERSE of the bandage, and at each reverse you put in a pin to prevent it falling down; you must be careful to roll your bandage from below upwards, and support the whole limb by a general pressure, that you may be able to

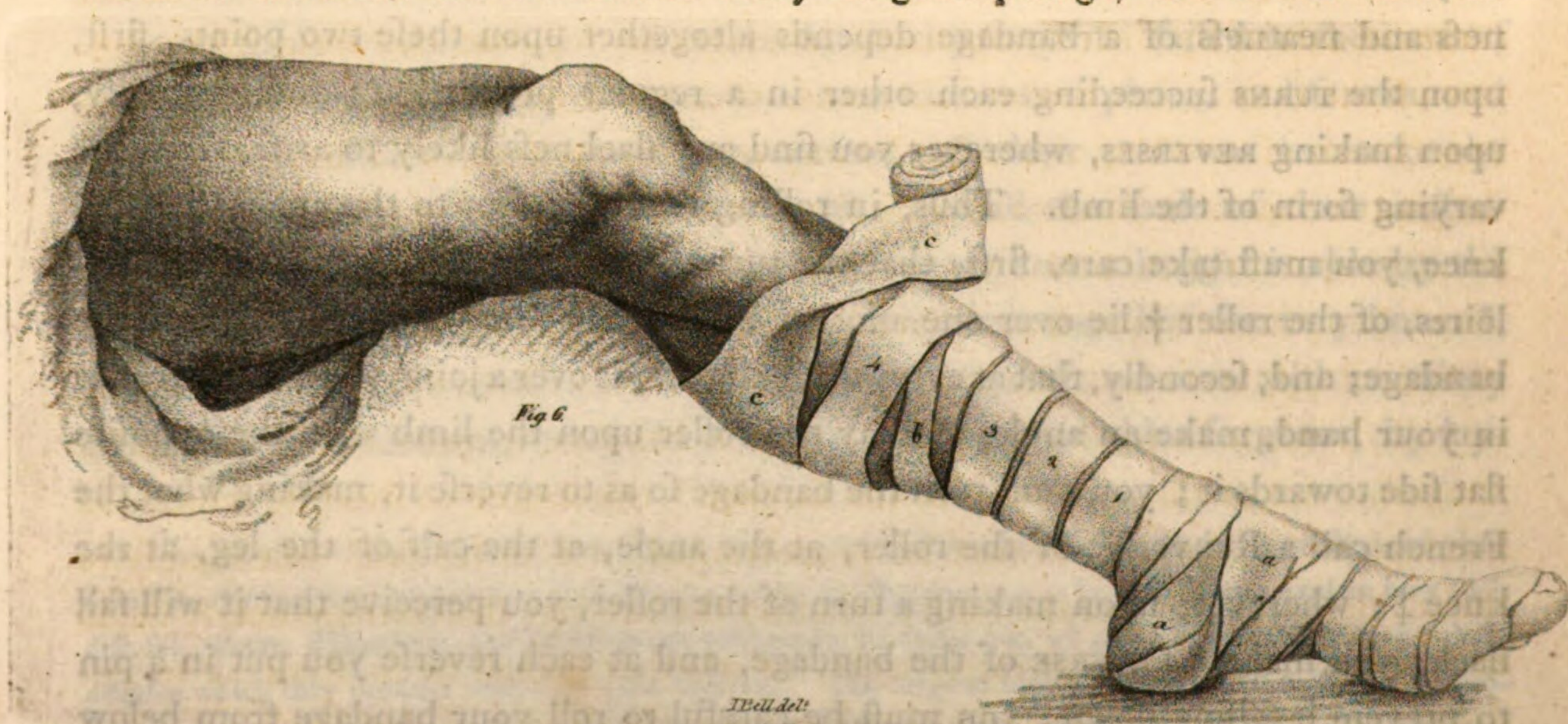
* The ancient surgeons knew more of this than the moderns. In the preface to the treatise of Galen on Bandages, we find the properties of a roller thus enumerated: "Efficit enim ut quæ abscefferunt propellantur, hiantia conjungantur, perversa dirigantur atque omnium contraria prestentur."

† The Dolloires are marked in the plate in next page, 1, 2, 3.

‡ Renversées of the roller are marked in the same plate, a, b, c.

support the diseased part with a particular pressure; you must lay compresses upon the hollows, and upon the bed of each particular abscess, and change the place of these compresses from time to time, so as now to prevent matter sinking into a particular hollow, now to press it out from a place where it is already lodged, and again to reunite the surface of an abscess already completely formed, from which the matter has been already discharged.

4thly, IN THE CASE OF A FISTULA, or where the abscess has hardened into a callous tube, while you pare away the callous edges, or cauterize them; while you open particular mouths of the fistula with the knife, or dilate them with sponges (which you should prefer if you are afraid of an hospital fore); while you stimulate the internal surfaces with gentle solutions of corrosive sublimate, spirits, or stimulant balsams, as solutions of gum, aloes, &c. in spirits; you must lay such a train of compresses along the course of the fistula as will bring the sides into contact; and when you use a seton, whether it be in fistula, to excite the tube, or in irregular abscess, to lead the matter, and concentrate the disease, you learn by means of the seton the direction of every irregular passage, and hollow tract in



the limb, and know, of course, where to lay your train of compresses, and what form to give them.

In a limb full of disease, undermined with suppurations; in that complication of disorders which I have already described of swelled joints, fistulous or irregular abscesses, or diseased bursæ pouring out their peculiar matter in profusion, the roller serves every purpose at once; and in addition to these uses which I have just described, it gradually overcomes the general swelling of the limb: for this swelling is either a leucophlegmatic swelling, which this kind of support dissipates quickly, or it is a low inflammation in which this general support is still more needed: such inflammation proceeds merely from a gorging of the vessels; and stimulating fomentations, camphorated oils, and a well rolled bandage, are the surest cure. This last use of the bandage, viz. of dissipating swelling, and suppressing this low inflammation, I shall be able to set before you, in a strong point of view, by stating one observation which I have often had occasion to make. Surgeons have hitherto complied with a very absurd practice belonging to the old surgery, viz. the rolling and bandaging of a broken limb. The old surgeons meant by their complicated bandages to regulate the form and quantity of the callus; but modern surgeons, who know better things, who have no expectation of affecting the callus by any outward pressure, who have indeed no design but that of keeping the limb straight and quiet, no motive for rolling or bandaging a broken limb, yet continue this practice! The terrible accidents which sometimes happen from imprudent bandaging, had indeed been the occasion of endless disputes about the degree of firmness with which a broken limb should be rolled, while in truth the effect of such a bandage is quite uncertain, and is altogether out of the command of the surgeon! the degree of stricture which the bandage will make must always be proportioned, not to his skill, but merely to the accidental swelling of the limb; whether the bandage shall remain nearly slack, or whether it shall be moderately tight, or whether it shall be so strait as to endanger gangrene, must depend altogether upon the degree of that swelling. The country surgeon rolls up a fractured limb, and it is long before he visits his patient a second time; the patient thinks it a duty to bear every uneasiness of his situation, knowing that his leg was bound up by a skilful surgeon; if unhappily the limb swells, and matters be left in this state for two days, it falls into gangrene: but if the surgeon fortunately sees it in twenty-four or thirty-six hours, he is just in time to save it; he finds the bandage very tight, the foot swelled to an enorm-

ous degree, the inflammation dark coloured and livid, the leg spotted with gangrene, and studded with small vesicles, and each turn of the roller has left its mark in the limb.—What should be done with such a limb? Stop a moment and think what should be done? Should the bandage be cut off, and the limb laid at its ease upon a pillow? Should it be wrapped in a relaxing poultice? It is inflamed! should it therefore be treated with leeches, and continual fomentations? Surely not, we must do the very reverse of what is usually done in such cases. The practice which should be adopted explains pointedly the very thing to which I would now direct your attention. Such low inflammation, whether produced suddenly by a tight bandage, or slowly by the general disease of the limb, is best cured, not by taking away the bandage, but by applying a firm and well rolled one. This accident happens too often for me to be deceived in what should be done. When I find a limb in this condition, swelled by an ill applied roller, if it be already gangrened, I let it alone, but if it be recoverable, I cut off the roller, compress, and work, and smooth the parts with the hands, roll the limb very carefully, nicely, and firmly from the very toes, and moisten the bandage with spirits of wine: we must proceed expressly in the same careful manner with a diseased limb, for the swelling is of the same nature. Cutting off the bandage from such a limb as this, and laying it at ease, will but solicit more swelling towards that part, just as laying a diseased limb in poultice will perpetuate the disease: by applying a roller judiciously, we prevent the swelling of a member, or recover one that is already swelled.

It is in the complicated case of a swelled and diseased limb that we are sensible of all the uses of a bandage, which is a universal cure for all its disorders. By the bandage we dissipate the leucophlegmatic swelling, abate the inflammation, prevent the extension of matter, lessen suppurating cavities, close the walls of fistulas, procure the reunion of surfaces which have suppurated. The patient is sensible of an easy and pleasant firmness from the bandage, and the limb is actually supported against accidents, and the further extension of the disease. This effect of bandage is observable, not merely in this single case of an ill bandaged limb, but is equally obvious and interesting in other cases; for in varices, though a permanent bandage is usually required, yet sometimes the parts are so strengthened by a roller that they recover their tone. It is also by curing this low inflammation, restoring the tone of the parts, and strengthening their action, that bandage cures ulcer in the leg. If you have seldom seen ulcer even rendered

stationary by a bandage, much less cured by it, remember how very ignorantly you have seen such rollers applied. You have seen them drawn round the ulcer, round the shin alone, with the firmness of a tourniquet; the middle of the leg bound very tight, the foot swelled, the ulcer inflamed, the marks of the roller left in large ridges; you have seen it recovering in the morning, only to be tortured into the same condition before night! the limb truly little short of that condition which I have just described in the case of a broken limb imprudently bandaged, livid, swelled, and verging towards gangrene. Instead of this it should be rolled from the very extremities of the toes, and then roll it as tight as you will you can do no harm. It should be rolled in the morning upon rising from bed, in such a manner as to fit it to bear the fatigues of the day; to support and defend the ulcer, and keep the swelling all above the fore; this constitutes the true value of the sticking plasters, which have been so successfully used by Dr. Bainton: First, The fore is thoroughly cleansed, its edges smoothed and wrought forwards, and firmly compressed by the drawing of the plaster: Secondly, The limb is rolled from the toes to the fore, then over the fore, and some way upwards, so as to secure the relaxed parts; the bandage so rolled, by a skilful hand, is the only certain cure; neither ointments, nor mercurial preparations, nor sponges, nor leaden plates, will cure an ulcer, it is to be cured only by firm, equable, and perfect compression, which must be renewed more than once a day if the bandage becomes loose. There is no inflammation of the lower extremities in which I do not experience the good effects of firm rolling. Even mere feeling and vulgar experience instruct a man when he has an ankle sprained to bind it firm; and in a diseased bursa (as in a relaxation of the knee joint), that disease, which with but a little indulgence, a very little encouragement of fomentations, poultices, bleedings, and low diet, would end in white swelling of the knee; may be stopped even by so simple a matter as a well rolled bandage. Stimulants, as calomel, opium, and good diet, will keep the system well; and the joint itself may be excited to a healthy action, by pouring hot mineral waters on it, by animal oils, camphor, laudanum, frictions, and most of all by supporting the action thus excited by a general roller, well and carefully applied, and by particular compresses applied upon each bursa. By a compress, merely on each side of the knee joint, when the great Capsule of the joint itself was swelled, I have reduced the size of a dropical knee by the quantity of three or four ounces in a night's time; the fluid being fairly and une-

quivocally absorbed, without any deception arising from its being pushed into the surrounding cellular substance. I have frequently in a few days reduced prodigious dropfical swellings of the knee, relieved the patient from great pain, restored the use of the limb, and made an absolute and permanent cure. The common sprain of the ankle also is a slighter disease, a temporary one of those *burfæ* which accompany the *Peronæi* tendons. It seems to be accompanied with very quick and active inflammation; if it be but a little indulged by long fomentation in tepid water, leeches, poultice, and such things as relax the parts, it is rendered a very tedious disease, and the joint becomes swelled and gummy, lame for months, and rheumatic for years, and liable to be easily hurt again by the slightest strain upon it; but if this swelling be opposed vigorously by hot fomentation, continued but for a short time, camphorated spirits, a very firm bandage, and long compresses firmly pressed down behind the ankle, and if after a few days cold water be poured upon the joint, if it be rubbed, and still firmly bandaged after it seems well, it will be easily cured, and no remaining weakness left to remind us of the accident. Be assured, that much of the success, and all the skill of quacks in sprains, consist in applying bandages. When they do harm, it is by using bandages when they should not be used. When they do good, it is by a fortunate use of this simple process which I am now recommending to you.

By compression merely, ganglions may be obliterated, tumors of various kinds dissipated, and proud flesh or fungus suppressed: indeed much may be done by compression, which it is no part of my design to mention in this place. I am satisfied with remarking some common and useful facts, which are not to be regarded as trivial, when they serve to establish a general conclusion in your minds; and these general remarks will, I trust, be found important, as furnishing rules of conduct in the daily duties of your profession, and be the more acceptable, as they are not imposed on you with the forbidding formality of aphorisms.

It is not surprising that the forms of bandages are ill explained; I never could perceive that even the general intention and properties of a bandage were sufficiently understood. Bandaging a wounded or diseased part is not a mere ceremony, nor is it used only for parade and for the credit of the surgeon, else we should stick to the antique bandages of Galen and Soranus; we should prefer the *scapha*, or boat-like bandage, the *gallia gladiatoris*, or bandage like a gladiator's helmet, the *regium*, or bandage in form of a crown! to any that we now see. Those innumer-

able forms in which the ancients turned the roller round the head, neck, and body (plainly intended more for parade than use), are to be found in the treatises of Soranus, Glaucus, Diocles, and Galen. In their treatises I find nothing but what has fallen into deserved neglect, nothing that I could mention either for your amusement or instruction. But since those days, the subject has become even more perplexed, no one author has understood another; we have in one book descriptions without drawings; in another, drawings without names; in a third, descriptions, drawings, and names, so confused, that we are apt to lose all the conceptions we have ever formed on the subject. He would be a very active, and, at the same time, a very idle man, who should set himself to disentangle all this confusion for you, and prove by express authority and quotation where the intentions of Soranus, Heliodorus, or Galen, were exactly fulfilled by the descriptions and drawings of modern authors. This is the only occasion in which I would interdict you the study of history! Why should we go back to the ancients in this pitiful manner to learn from Galen or Soranus to tie up a limb? If common sense and ordinary ingenuity, and the knowledge we now have of the higher parts of our profession, cannot support us in so plain a matter as this, we must think very poorly of ourselves; but as Paree observes, I see nothing to persuade me "that nature has lavished all upon the ancients, or that she has quite played the stepmother with us." I hope to make the study of this department in the history of your profession quite unnecessary for you, by explaining to you a neat short system of bandages, and as I go along I shall endeavour to point out such things in the history of each bandage as it is right that you should be acquainted with.

I have reduced all bandages to those few which are represented at the head of this chapter. It is very true, that if you put a roller merely into the hands of a skilful surgeon, he will turn it so curiously round any part of the body, as to ensure every possible purpose; but this he will accomplish best who is most familiar with every other kind of bandage; and there are really certain bandages peculiarly, and, as it were, naturally appropriated to certain parts of the body. The characters and properties of those which I am to describe are as follows.

The LINTEUM SCISSUM, or Split Cloth, marked No. 1. is peculiarly adapted to the head: it covers the whole scalp, and its legs or split parts tie firmly round the

occiput and forehead ; it may be made with six or with eight tails, according to the parts you wish to compress *.

The SINGLE SPLIT CLOTH, or bandage with four tails, No. 2. which is called the CAPISTRUM or Stirrup, or the FUNDA or Sling, is the proper and peculiar bandage for the face : in cuts of the forehead, or of the face, of the nose, of the lips, in fractures of the jaws, and in every wound which is beyond the circle of the hairy scalp, we use the Sling, or Double-tailed bandage.

The T BANDAGE, No. 3. which is named from its resembling the letter T, is the peculiar bandage of the body. If the breast or belly be wounded, we make the circular (a) very broad, which serves as the proper bandage of the body, and we split the tail-part (b), and passing one leg over each side of the neck, we pin it to the circular, so that it forms a suspensary for the main bandage, which prevent its slipping down. But if we have a wound, or disease, or operation near the groin or private parts, the tail-part becomes then the most important part of the bandage ; then the circular is smaller, and goes round the pelvis, while the tail-part is made very broad. When the disease is in the private parts, perineum or anus, we often split the tail according to circumstances ; but when the disease is in one groin, we generally leave the tail-part of the bandage entire and broad.

The ROLLER, No. 4. is the peculiar bandage of the limbs, for accomplishing all those objects which I have just explained to you ; it serves for the limbs, shoulders, haunches, and occasionally for the body ; it is often singularly useful in bandaging the head, where peculiar firmness is required, and there always you are to use the double headed roller. You take one head of the roller in each hand, and by that which is in your left hand, you fix down the turns of that which is in the right, so that you can make your bandage smoothly firm over the whole head, can knot it at particular points, can turn it in every direction, and fit it to every occasion. Wherever the roller is to be used as a uniting bandage (i. e.) to be applied round any part, so that the legs meet and cross each other over a wound (to draw its lips close together), we make a slit in the roller, see No. 5. and pass one of the rolls through it, and thus we make the decussation of the bandage very sure, and give it peculiar effect upon the wound. These are the four bandages which I proceed to describe, and I believe I shall satisfy you that you may throw aside every other.

* Marginal plate at the beginning of this chapter.

OF BANDAGES FOR THE HEAD.



J. Bell del.

The head, from its shape, admits with difficulty the application of a bandage ; it is more frequently wounded than any other part, and it is wounded very irregularly : When the scalp is generally bruised, or cut in many places, it requires the Linteum Scissum, or Split Cloth, which may consist of six or of eight legs ; and these are put round the head in various ways.

1st, When the cloth has six heads, it is applied as in fig. 7. 8. 9. The middle or unsplit part of the cloth (vid. c fig. 1. 7. 8. and 9.) is applied to the middle of the head. The two tails (d d) go round the temples, and are pinned at the occiput ; the two other tails (e e) go also round the temples, and are pinned over the forehead ; the two middle tails (f f) are usually directed to be tied under the chin, but this suffocates and heats the patient ; and unless it is necessary for the security of the general bandage, I prefer tying them over the top of the head, or obliquely, in order to press firmly upon any particular point.

The older surgeons usually split this middle tail into two parts, one broader, and the other narrow ; in the broad one they made a hole to let the ear pass

through, and tied that broader one under the chin, and the narrower they tied over the head obliquely. Though this gave the split cloth the effect of eight tails, yet they did not name it the split cloth with eight tails. When they split the cloth into eight tails, and especially when they tied the eight tails in the following particular manner, they called the bandage *CANCER*, as resembling a crab in the number of its legs. The *CANCER*, or split cloth of eight tails, was laid so over the head (vid. fig. 10. and 11.), that four tails hung over the forehead and eyes, and the other four hung over the back of the head; they were tied in the following order: first, the two outermost tails, before marked (a b), were tied over the forehead, and the tails (c d) left hanging over the knot; then the two outermost tails behind, viz. e and f*, were tied round the occiput; then the middle tails were tied! first c d, the two middle tails before were crossed over each other, carried round the temples, and pinned at the occiput; then g h: The two middle tails behind were crossed over each other, carried round the temples, and pinned over the ears, or near the forehead †.

OF THE FOUR TAILED BANDAGE, OR SINGLE SPLIT CLOTH.



J. Bell del.

* N. B. f cannot be seen in fig. 10. because it is on the farther side of the head; but in fig. 11. e f are seen hanging down behind the knot which they form, being tied under the occiput.

† Medium amplecti debet universum caput, sic ut quatuor partes a fronte recte dependant ab occipitio totidem ex illis exteriores ad occipitium porrectæ inter se alligentur: ex his exteriores similiter fronti circum-

The Four Tailed Bandage, or Single Split Cloth, is the peculiar bandage for the forehead, face, and jaws; if the forehead be the part wounded, this simple and very convenient bandage is applied, as in fig. 12. The bandage is made by taking a strip of cloth not quite so broad as the palm of the hand; it is to be torn or split up at each end, so as to leave only a convenient length of the bandage entire to be applied to the wound; the middle or unsplit part (a) is applied to the forehead, one tail (b) is carried round the back head to meet its fellow. The other tail (c) is carried, as seems best, either upwards over the crown of the head, or downwards so as to tie under the chin.

If the top of the head or *sinciput* be the part wounded, the bandage may be applied, as in fig. 13. laying the unsplit part (a) upon the wound, making one tail (b) pass down under the chin, while the other (c) is long enough to go round the head like a fillet, so as to secure the bandage from slipping backwards and forwards. It may go round to the occiput only, or it may go round the occiput and return to the forehead, and tie there.

In cuts of the lip or nose, or both, after putting proper stitches in the nostril, lip, &c. we apply the funda or sling, as in fig. 14.; we make one small opening to receive the tip of the nose, and we do not forget to make two small holes opposite the two nostrils for breathing. If the nostril or the tip of the nose be much wounded, or almost cut off, after putting in one or two stitches with the needle, we wrap lint neatly round the quills to put into the nostrils. The quills serve for breathing through, and the lint dilates and pads up the nostrils, so as to keep the nose in its proper shape, and by distending the nostril it keeps the parts in very nice and equal contact; one tail of this bandage ties at the nape of the neck, the other crosses its fellow at the back of the head, and then turns round to meet it, and to tie on the forehead; and sometimes the lower part also is brought round to tie at the forehead. If the upper lip be cut, and a bandage needed (which seldom is the case), it is almost superfluous to say that this bandage will serve the purpose. It serves also in cuts of the lower lip, though there also we trust rather to hare-lip pins than the bandage; but this bandage is particularly useful in supporting the lower jaw where it is broken. This bandage, when applied thus to support the lower jaw, is named *Capistrum* or *Bridle* (as it goes round the jaws somewhat like a horse's halter). In some

datae a latere diligentur, tum ex reliquis quæ in fronte scissæ partes sunt ad occipitium quæ in occipitio ad frontem attrahantur. GALENUS DE FASCIIS.

cases the circumstances require us to support the chin particularly, and then the unsplit part of the bandage is applied upon the chin, with a small hole to receive the point; but where the jaw is broken, we pad up the jaw-bone into its right shape, with compresses pressed in under the jaw, and secured by this bandage; where we are in fear of hæmorrhagy after any wound or operation near the angle of the jaw, we can give the sling a very remarkable degree of firmness. For this purpose, we tear the band into three tails on each side, we stitch the bandage at the bottom of each split, lest it should give way when drawn firm; and having laid our sponges first into the bleeding parts, and then laid compresses above them, we make the tails of the bandage depart from each other just over the point where the danger is, as in fig. 15. where two tails (a) turn round under the occiput, and are tied there; two others (b) cross each other a little higher, come round by the temples, and tie upon the forehead; and the two other tails (c c) may either tie upon the top of the head, or return and tie under the chin. In those cases, strong and firm pressure being required, it is not amiss to have two legs of the bandage long enough to be just twisted at the top of the head, and to return and tie under the angle of the jaw with a firm knot. But for purposes like these, viz. of suppressing hæmorrhagy after operations, or supporting a broken jaw, or plugging up a gunshot wound where there is great hæmorrhagy, such as we cannot command with the needle, there is a certain form of the double-headed roller, which I shall presently recommend in preference to this; it is named the Knotted Bandage.

OF THE COUVRE-CHEFF, OR KERCHIEF.



J. Bell del.

These are the peculiar bandages for the head and face. The much celebrated *Couvre-Cheff*, or *Kerchief*, I can hardly consider as a bandage; it is no better than a night-cap; it can serve no purpose of compression, whether to unite wounds, or suppress hæmorrhagies, or prevent the spreading of suppurations under the scalp; it serves no other purpose than to keep on the loosest dressings. When you have performed the operation of *trepan*, and have merely to lay a piece of lint upon the wound, you may use the *couvre-cheff*, or handkerchief, which is applied in two ways; either in a triangular form, the thick part applied to the forehead, the angle thrown over the head, and the points passing each other on the occiput, and brought forwards and pinned over the forehead, in a manner which is too common to need any drawing.

The other manner of applying the handkerchief, called the *Grand Couvre-Cheff*, or *Great Kerchief*, is as follows:

You take a large handkerchief, and fold it, not in a triangular, but in a square form; you let one edge project about three fingers breadth beyond the other, in order to form a general border for the bandage; you lay the handkerchief upon the head, so as to make the lower fold, to which the projecting border belongs, lie next the head; and the projecting border hangs flapping over the eyes till the bandage is all adjusted. These two figures, fig. 16. and 17. show the successive steps by which the bandage is adjusted. Fig. 16. shows the kerchief laid loosely on the head; (a a) are the two corners of the outermost fold hanging down; the first step is to tie them under the chin; (b b) marks the projecting border, which is to be turned back, and pinned in a circular form round the face, at the time that the corners of the fold next the head, marked (c c), are carried backwards.

The third motion is, to carry the two corners (c c) of the fold next the head backwards, where they cross each other at the occiput, and either are tied there, or are brought round again, so as to be pinned down over the ears, or thereabout, but shorter or longer, according to the length of the handkerchief. The fourth point in adjusting this bandage, and which finishes it, is explained in fig. 17. where it is seen, that after the outer corner (a a) has been tied under the chin, after the inner corner (c c) has been drawn out and carried round the occiput, and after the border (b b) has also been turned back and pinned, the doubling of the handkerchief at (d) is left loose, and very clumsy, hanging over the neck; therefore it remains to gather up this clumsy part of the napkin, to

fold it neatly, and to pin it up above the ear. I am sorry to spend so much time in describing a bandage which I cannot much commend; it makes no particular pressure; and, by its weight and closeness, heats and suffocates the patient. Indeed, I know hardly any good property it has but one; as Heister says, "It keeps out the cold; for which reason it has come into very general use with us," i. e. in Germany and Holland.

OF APPLYING THE ROLLER TO THE HEAD AND JAWS.



But the Roller is the universal bandage; it supplies occasionally the place of all those which are peculiar to the head or face; is applied to the head in the following manner; 1st, As a uniting bandage. When the cut is, for example, on the forehead, the two heads of the roller are crossed over the cut, by passing the head at one end, through a noose in the other end; and I find it of infinite advantage to touch either the roller itself, or the skin near the cut, with some adhesive plaster, which gives the roller a firm hold upon the skin, fig. 18. where the roller is supposed to cross over a wound.

2dly, In great lacerations, or in extensive suppurations of the scalp, the general pressure which such a case requires, may be made by turning the double-headed roller with both hands round the head; and while the right hand surrounds the head with circular turns, the left hand crosses the top of the head at each turn of the roller, and, when finished, it makes the bandage which is drawn, fig. 19.

It is called the CAPELLINE BANDAGE, and is the same with that which was a few years ago used for binding up a stump after amputation.

3dly, When the jaw is broken, the double-headed roller keeps the parts very firm, and this bandage winds in every direction which the exigencies of the case may require; for whenever you wish to turn the bandage to make it peculiarly firm, you have but to cross the rollers, and change hands. But there is nothing so peculiar in this form of bandage, nor so far differing from the capistrum, or split cloth, as to need a drawing.

4thly, In every case of dangerous bleeding from about the jaws, the parotid gland, the ear, &c. I prefer that form of the double-headed roller which is seen in fig. 20. when at each turn you twist and knot the bandages over the point where the danger is; whence this form of the roller is called particularly the KNOTTED OR TWISTED BANDAGE.

BANDAGES FOR THE NECK AND BODY.



Having already described the proper bandage of the limbs, which is indeed but a single roller, I shall proceed to explain to you how that roller is to be turned round the body. The chief difficulties are in approaching the body, I mean, in making the roller turn from the head over the shoulder and back, or from the thigh over the groin; and this must be taught rather by drawings than description. To be plain with you, bandage cannot be of much use in wounds or diseases of the neck: there we must, in case of wounds, expect reunion from the closeness of our stitches; and in fistulas of the neck, we expect a cure rather from setons, and other modes of dressing, than from the compression of a bandage. But the bandage which is generally used I have represented in fig. 21. it is made with a double-headed roller, begins with one turn round the forehead, and then descends by crossings over the neck, then turns round the body, then up again upon the neck; and by thus turning it round the neck, or over it, and crossing in various forms over both neck and shoulders, we can make it tolerably firm. This bandage is useful especially when, after pursuits with horse, many of the infantry are brought in, who have been cut down with wounds of the sabre about the back of the head, the neck, or the shoulders.

2dly, The next and greatest difficulty is in approaching the trunk from the arm, and turning the bandage over the shoulder. The best form of bandage is the very old one, represented in fig. 22. named *Spica*, because, when made, it resembles somewhat an ear of corn. We begin the bandage at (a), by laying the middle of a double-headed roller under the axilla; we carry the two heads first round the body, then obliquely up over the breast and back, and make them cross each other over the shoulder, (b); both heads are then carried round the affected arm at (c c), then up again over the same shoulder, and cross upon the top of the shoulder, and then down again over the breast and back, so as to make a second turn (d) under the sound axilla, and then the roller is returned over the breast and back a second time to the affected shoulder. This *spica* bandage is sufficiently explained by the drawing; it is often made over both shoulders, and is then called the *Double Spica*, being made with equal crossings on the breast and back, and equal crossings upon each shoulder, both over and under it. This bandage is also used in approaching the trunk of the body from the thigh: the bandage is then called *Spica Inguinalis*, the *Spica* of the Groin, and begins with a turn round the pelvis.

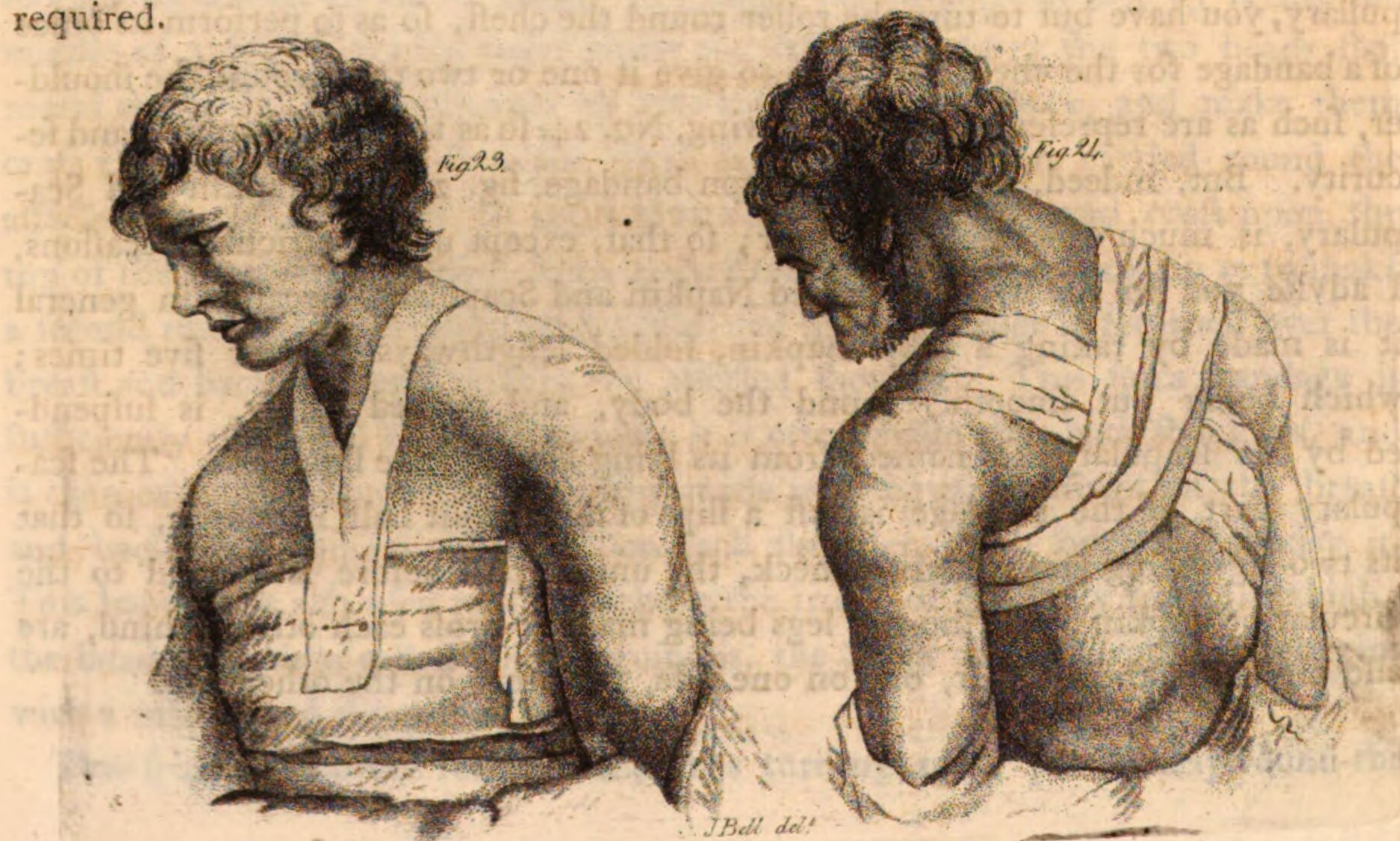
This *spica*, in various forms, sometimes turning more particularly round the

pelvis, and sometimes turning chiefly round the limb, according as the trunk or the limb is most wounded, makes a very firm bandage. In fractures of the clavicle, in wounds about the upper part of the breast, in hæmorrhagies from the mammary arteries at the top of the breast, in fractures near the head of the shoulder-bone, in amputations very close to the trunk of the body, we find this bandage, the *Spica Humeri*, very useful. The *spica inguinis* is equally useful in hernias of the groin, in luxations of the thigh bone, in wounds of the upper part of the thigh, or lower part of the belly, in supporting aneurisms of the femoral artery, and in a thousand indescribable cases.

3dly, When the thorax is wounded or diseased; when the ribs are much broken; when the sternum is carious, with suppuration; when a schirrous breast has been extirpated; when we perform the operation for empyema, (that is, when we make an opening to let out matter confined within the chest); we may use either of these two bandages, the *Stellated Bandage*, fig. 24. or the *Napkin and Scapulary*, fig. 23. The *stellated bandage* (so named from the turns of the roller crossing each other in a star-like form), is the more useful where a particular and powerful pressure is required: it may be fixed, and prevented from shifting, by putting in pins from point to point, and it signifies little where it begins or where it ends. This drawing, No. 24. will enable you to practice this kind of roller; and you will learn also from it how to fix the broad roller round the chest; for if at any time you should prefer this simple broad roller to the napkin and scapulary, you have but to turn the roller round the chest, so as to perform its office of a bandage for the chest, and then to give it one or two turns round the shoulder, such as are represented in the drawing, No. 24. so as to give it firmness and security. But, indeed, the more common bandage, fig. 23. the *Napkin and Scapulary*, is much easier and pleasanter; so that, except upon particular occasions, I advise you to use it. It is called *Napkin and Scapulary*, because in general it is made by taking a table napkin, folded lengthways four or five times; which being put smoothly round the body, and pinned firmly, is suspended by the scapulary, so named from its lying flat over the shoulders. The scapulary part of the bandage is just a slip of linen split half its length, so that its two legs being laid round the neck, the unsplit part before is pinned to the circular or napkin; and the two legs being made to cross each other behind, are also pinned to the circular, one on one side, the other on the other side.

The T bandage, belonging to the groin or private parts, is so continually used, while almost all other bandages are neglected, that it would be as superfluous to explain it, as it is useful to explain the others. I have given no drawing of the T bandage; but in respect of all the others, I have acquitted myself in my duty towards you, so as to be satisfied in some degree with what I have done. I find, indeed, that I have not entered so much into the history of the old forms of bandage as I once imagined I should need to do, in order to make my own system intelligible. I have first explained fully the uses of each kind of bandage; I have selected for you, from the obscurity of the ancient, and the inconsistency and confusion of modern authors, a short intelligible system in which you will find no discrepancies and perplexities of names, descriptions, and drawings; for, when I had settled upon the system which I was to recommend to you, I put each bandage upon the living body, set the subject before me, and as I described I drew.

I will not tell you, what has been but too often repeated, that the NIGHT-CAP, WAISTCOAT, and STOCKING, will at times supersede every other bandage. I must rather remind you, that, as a general doctrine, this is quite opposite to the principles which I have laid down. It is a way of speaking that favours too much of that slovenly practice in which poultices, fomentations, filth, and rottenness, and diseases, go hand in hand. The night-cap, waistcoat, and stocking, supersede no bandage; they are only useful where bandages are not required.





DISCOURSE V.

ON HÆMORRHAGY.

A HISTORICAL AND PRACTICAL DISCOURSE ON THE EFFECTS OF HÆMORRHAGY—
THE VARIOUS MEANS OF SUPPRESSING HÆMORRHAGY—AND THE DOCTRINES
OF MODERN AUTHORS CONCERNING THE RETRACTION OF ARTERIES.

TO expire by successive hæmorrhages is perhaps the least painful of deaths, and yet it is the most awful. The repeated loss of blood so directly intimates approaching dissolution, and the patient feels his spirit and strength ebbing so perceptibly at each return of hæmorrhagy, that he clings to life. Those of the most resolute mind are overcome with anxiety which they cannot conceal, and look round for some one to delay at least the fatal moment: and the surgeon

feels himself so responsible, that with him it is truly an anxious scene. If the bleeding be slow and gradual, from some extensive surface, as from a polypus of the nostrils, from the womb, from the surface of a stump, or from some extensive sore, the surgeon is sent for from hour to hour; he is called during the night; he is made unhappy for weeks; and, after repeated uncontrollable hæmorrhages, he sees his patient expire. But, if there be a sudden hæmorrhagy from the vessels cut in any operation, or from an aneurism, or from some great wound, the arteries of which cannot be discovered, there is immediate danger of the patient expiring even in the surgeon's hands.—Let those who have witnessed the agitation of such scenes judge of the importance of that subject which I am now to explain to you; indeed I may appeal directly to yourselves! Is not this fear of hæmorrhagy always uppermost in the mind of the young surgeon? Were this one danger removed, he would go forward in his profession almost without fear.

It is the dashing of the blood from the great arteries, and the fainting of the patient, that hurries our most important operations, and makes all the difference betwixt operating on the living body, and dissecting the dead. It is this which unsteadies at times the hands of the boldest surgeon, and makes his heart, at the first alarm, sink within him. No surgeon nor spectator can keep the natural colour of his cheek when a patient is expiring, or in danger of expiring, by loss of blood; and the actual death of a patient must leave a lasting melancholy on the surgeon's mind.

It is really this accident of hæmorrhagy that has retarded the improvement of our profession for ages! for the ancients, ignorant of the ways of stopping hæmorrhages, did not venture to cut out the most trivial tumor, or they did so with fear and uncertainty. They performed those operations slowly and imperfectly with burning irons or ligatures which we now perform rapidly and safely with the knife. If they ventured to amputate a member, it was only by cutting after it was gangrened, among the putrid flesh. They merely separated parts which were already dead and bloodless; so great was their abhorrence of blood.

In slow and in sudden hæmorrhages the symptoms are very different. In those slow hæmorrhages which arise from polypi, from smaller aneurisms, from ulcers where the veins and arteries are deeply eroded; in hæmorrhages from the surfaces of the nostrils, stomach, lungs, or womb; from varices of the lower extremities, or from the hæmorrhoidal veins, the patient is very slowly exhausted. At each re-

turn of bleeding the patient faints, and is laid in bed, and the cold applications and the fainting save his life. He rises, after some days, pale, languid, and giddy. The pulse flutters, and is hardly to be felt; the breathing is quick and anxious, accompanied with sighing and great oppression; the heart palpitates on the slightest motion; and the slightest inclination of the head, or rising suddenly from the couch, endangers fainting. The voice is low; the eye is languid, colourless, and of a pearly white, like that of a consumptive person; the flesh feels soft and woolly, and the skin is pale, yellow, gelatinous, and, as it were, transparent like modelled wax. The complexion of the lip or cheek never returns, even if the person should recover. After this stage of weakness the blood loses its colour; from this time forward it is a bloody serum only that distils from the vessels; dropsy appears; and the slightest loss of blood proves fatal.

But when the patient expires suddenly by an impetuous bleeding from some great artery; when he dies of the bleeding from a femoral aneurism, or amputated limb; when he is wounded among the viscera, and some great vessel is pouring out blood, the symptoms are the same as in that sudden uterine hæmorrhagy which happens in the latter months of pregnancy, in consequence of the placenta being implanted over the orifice of the womb. The blood in the general circulation, in place of being forced onwards by the contractions of the arteries, runs backwards towards the wound from all parts of the body. The arteries no longer push on the contents of the veins; the blood ceases to flow towards the heart; the heart ceases to act; and the countenance assumes, as in asphyxia, a livid hue from want of circulation. The face becomes all at once deadly pale, the circle round the eyes is livid, the lips are black, and the extremities are cold. The patient faints, revives, and faints again; with a low and quivering pulse, he is sick, and his voice is lost. There is an anxious and incessant tossing of the arms, with restlessness, which is the most fatal sign of all. He tosses continually from side to side; his head falls down in the bed; he raises his head at times suddenly, gasping as it were for breath, with inexpressible anxiety; the tossing of the limbs continues; he draws long convulsive sighs; the pulse flutters, and intermits from time to time, and he expires. The countenance is not of a transparent paleness, but of that clayey and leaden colour which the painter represents in assassinations and battles; and this tossing of the limbs, which is commonly represented as the sign of a fatal wound, is indeed so infallible a sign of death, that I have never known any one recover who had fallen into this condition.

Fear and horror lead to superstition ; and in stopping hæmorrhages many superstitions were practised. There was, in the dark ages of the 16th and 17th century, a grotesque mixture of philosophy and magic ; the physicians wished to appear philosophers, and to operate by natural powers ; and yet their chief confidence was in charms and incantations. Philosophy, such as it was in those days, they trusted to, only, when incantations failed. The iron ore Hematites was so named, because they were persuaded that the very touch of it would suppress bleeding : and Wolffius says, “ *Cur jaspis tacto vulnere unde sanguis prorumpit eum sistat nondum novi.*” The reason of the singular effects of the sympathetic powder, and other charms for stopping hæmorrhages, they durst not inquire into, but they believed and wondered. They tied live toads behind the ears or under the arm-pits, or to the soles of the feet, or held them in the hand till they grew warm, in order to stop hæmorrhages. Some imagined that the toads operated by causing fear and horror ; but all believed their effects to be very singular * ; and Michael Mercatus says that this effect of toads is a truth, which any person willing to take the trouble, may satisfy himself of, by a very simple experiment ; for “ if you hang the toad round a cock’s neck for a day or so, you may then cut off his head and the neck will not bleed a single drop !” Wolffius, and Senertus, and Michael Mercatus, and Hoffman, and Gottfried Mæbius, and many others, do greatly commend the live toad ! nor was there any thing that could come in competition with it ; since nothing could be imagined more unnatural, absurd, and offensive, unless indeed it were the moss which grows in a dead man’s skull †. In short they proceeded from folly to ob-

* *Bufo narium hæmorrhagiæ metum invincibilem, ponat si vel pone aures per se applicetur, vel pugno includatur ut caleseat, &c.* In the Appendix to the *Acta Acad. Leopoldino-Cæsar. Curiosor.* a very great author, tells us of a man falling into a dangerous bleeding from the nose in consequence of a swan which was carrying a toad away to its nest, having dropped it so unluckily, that it fell just upon the nape of the man’s neck ;—*ex rostro Ciconiæ in aere propter volantis delabente Rana.*

† Wolffius was the first among the learned physicians of the 17th century who found out how this moss was generated, or how to procure it easily—*ipsemet ego non impossibilem, &c. adjuvabimus autem ipsius generis faciliorem si crania suspensorum, (for always a thief or a murderer was of most use to the physicians) ; in umbrasis locis septentrioni expositis aut sylvis reponamus, five pendula reddamus.*” And he adds, “ *Alias sufflumen sanguini proruenti infigere creditur etiam muscus vulgaris,*” &c. “ Some are so weak as to believe that common moss will do, and that, when the Bears are wounded with arrows, they seek out some mossy bank, pluck some of the moss, and stuff it in, to stem the bleeding.”

For suppressing hæmorrhagy the ancient and learned physicians used an amulet made out of the right ear of an ass ! A hare’s fud had long been the favourite application to stop the hæmorrhagy of wounds !

scenity, and from obscenity to blasphemy, till they came to profane the most sacred things *. Their philosophical doctrine of Derivation and Revulsion was not unworthy of those who believed in these charms. In hæmorrhagy they tried rather to divert the blood than to stop it directly; they applied cupping glasses near the open vessels; put ligatures round the limbs, made strong frictions; or opened a vein in some distant part of the body; they operated from right to left, not diagonally but according to the direct line of the body; if there was hæmorrhagy from the left side of the neck, they bled in the left angle, not in the right; and for hæmorrhages from the right side of the head they bled in the right foot, ("et de latere dextro capitis ad pedem dextrum, non ad finistrum," Guido, page 171). Even down to our own days, tourniquets have been used for like purposes. Sometimes to keep in the blood, sometimes to drive it out! In profuse menstruation, tourniquets have been applied round the thighs and arms

but the following notable improvement upon hare's fur is recorded by Ab Heer, Lib. I. Cap. 5. "*Pilos e pube muliebri avulsos, inque nares virorum intrusos;—et e pube virili in fœminarum Nares immisos.*" The fascinating verses used by the German surgeons were shockingly blasphemous:

Gelijk Christus stil bleef Staen im Jordaen,

Also must ook dien bloede Staen.

* In those days it was neither styptics, nor medicines of any kind, but the Devil or our Saviour, that did all the good or harm in extraordinary cases. They had many counts against the old one, "*de perfidiis et de fraudelentia Satanæ,*" of Satan's tricks in crimping and hooking in young boys and ignorant women we have many sad and long narrations in the works especially of the Paracelsian Doctors. He was described in those days, as lately by Mr. Lewis, with horns, and claws, and faucer eyes;—"but the strangest thing of all is, upon his rump there groweth a great long tail, that useth to trail upon the ground as he goeth!"—Such were not the descriptions of the celebrated Wolffius, who differs from Mr. Lewis and the servant maids, in thinking that he does not always appear in this majesty of person, nor fly always out of the roof in flames of sulphur, that he shows himself some times in more familiar forms: "*Constat alias etiam quod Beelzebub sub forma muscæ et aranæ facile compareat,*" and all to beguile the simple; "*et simplicibus hominibus illa sub specie loco spiritus familiaris inserviat;*" and sometimes he is, according to these writers (who seem to have been very familiars of his), stuck in a looking-glass, or a seal-ring, or pent up, like Asmodeus, in a doctor's bottle; "*Sic in Francia et Italia venales reperivi demones Vasculis, speculis, phialis, aut annulos alligatis aut inclusos;*" sold, I suppose, like crucifixes, for fivepence a-piece. There is, among the *Perfidiis Satanæ*, one very terrifying indeed, recorded by Wolffius, which might well frighten the boldest, "*Que inter alia itidem quosvis detertere debet.*" "The devil one night stole away the muster-roll of a regiment, and next morning the soldiers were all seen hanging in the air by their cravats." *Demon militibus quibusdam noctu substraxerit schedulas, vel carmina quibus se antea contra hostium, virtutem et vires crediderunt, et experti sunt aliquoties munitos, (i. e. their Abracadabras), quo furto facto postmodum ii strangulati in aerem elevati perierunt,*" p. 554.

to prevent fainting and weakness ; and again, in sparing or suppressed menstruation, they have been applied to force the blood through the vessels of the womb ! De Goerter asks not in ridicule, but seriously, *An aligatis parvi articuli aliquid boni prestat in hæmorrhagia ?* “ I have seen this ligature of the Little Finger, says Goerter, practised by an old physician, who assured me upon his honour that he had often found it do infinite service, which I firmly believe.”

In hæmorrhagy, as in epilepsy and convulsions, and other horrible diseases, they trusted more to incantations than to natural means, or they used natural means hardly less superstitious than incantations. None of these was more whimsical, nor more degrading to the regular professors of surgery, than that of cutting up a live hen, and thrusting the bleeding member into it. Would you believe that this method of arresting hæmorrhagy, which had been learned from the hangman, or rather, indeed, from the hangman's wife, was not only mentioned respectfully by so celebrated a person as Platerus, but actually used by him ? “ A vicious horse having bitten off a man's thumb, and all kinds of things had been used to stop the hæmorrhagy, but in vain, I, when called, ordered a chicken to be slit up, and ordered him to thrust his thumb into it, and keep it there while the fowl was hot ;—his hæmorrhagy stopped in a moment*.”

* The story of the hen and the hangman's wife, which you have heard of but never perhaps authentically, nor with any proof of its belonging originally to so great a man as Platerus, is literally as follows :

“ When I was at Montpelier,” says Platerus, “ the servant of a certain priest, who knew that he carried all his money, to the amount of good 200 crowns about him, watched him one night when he was sitting by the fire roasting a partridge ; and, while he was twirling it about, came and knocked him down with a billet, and then was at the superfluous trouble of cutting his throat.”—“ About a year after, the villain was taken, and condemned to be divided into quarters, for the benefit of the whole city ; but before this he underwent the following initiating ceremony : He was carried to the square where he had committed the murder, and there the hangman cut off the right hand with an axe ;—but, lest he should die of the hæmorrhagy, the hangman's wife, in whose lap the thief sat during all his progress, took a live fowl, which she had provided, cut it up with a knife from the gut to the breast bone, thrust the bleeding stump into it, and tied it firm, and hooped it on with garters like a boxing glove. He was dragged on the hurdle for a whole hour, before he arrived at the spot where he was to finish his career ; and, to the admiration of Platerus, who followed him step for step, he lost not one drop of blood !”

“ *Famulus Canonici Monspeffuli, cum illic essem anno 1554. qui hunc suum herum, noctu ad ignem sedentem, et perdicem affantem, titione percussum, et cadentem, cultro jugularat et spoliarat, omne aurum suum quod 200 erat coronatorum secum portare solitum, ac post annum demum deprehensus, supplicio adjudicatus, cum antiquam in quatuor partes divideretur, manum utramque in platea, in qua ædes sitæ erant, ubi scelus hoc commiserat, illi carnifex amputasset, ne ex larga hæmorrhagia moreretur, sed vivus in locum supplicii ductus, illic in quatuor partes diffecaretur, et proin sanguinis ille vehemens fluxus impedi-*

Such has been the dread of hæmorrhagy in all ages, and such was the philosophy, the religion, the medical skill of all Europe, in the 16th and 17th centuries; but the ancients, as I have observed, more cruel and daring, had used heated irons, both for stopping hæmorrhages, and for almost all the great operations of surgery. In Apoplexy, Epilepsy, and Palsy; in Melancholy and Madness; in Headachs and Hæmicrania, they cauterized upon the coronal future with burning irons; they measured with the palm of the hand from the root of the nose, and where the midfinger fell they cauterized, not superficially, but down to the very bone, and they burnt through the first table of the bone, and afterwards scraped it so as to force it to exfoliate *! this they did after previously purging the brain. In Toothach, Ophthalmia, and Corryza, they burnt in the eye-lid, behind the ear, and in the nape of the neck. In Cough, Hoarseness, Pleurisy; in dropsies, swellings of the spleen, coldness of the liver, or coldness and moisture of the stomach, (quando accident in stomacho frigus et humiditates multæ), they cauterized the belly and thorax. Whatever we perform with the knife, the saw, the caustic, or the needle, they did with cauteries. With the cautery they exfoliated bones; destroyed tumors, as in the Antrum Maxillare, or gums; dried up ulcers; suppressed fungi; reunited fistulas; cured diseases of the hip-joint, and rheumatism and gout, and curvatures of the spine. It was in consequence of this ancient doctrine that the practice of burning for the gout with moxa was so favourably received in Europe. They cured the piles, and obliterated varicose veins by burning them. They thrust their burning irons through hydroceles and herniary sacs, to obliterate them. The cauterizing iron was

retur, hac ratione, a subitanea morte, præservatus fuit. Carnificis uxor, in cujus sinu latro curru vectus sedebat, gallum gallinaceum, vivum, interea cultro a podice versus illius sternum scindendo, aperiebat et brachium mutilatum, statum post ictum, in hanc aperturam intrudebat, postea fune circumducta, alis complicatis arcte ligabat, sicq. sanguis in altum saliens, repressus fuit, adeo, ut nihil inde sicuti diligenter, observavi, postea effluerit, et ultra horam, donec interemptus fuit, non debilior factus ex mutilatione, vixit."

This very valuable case Platerus follows up with the following head title:—" *Idem remedium, in digito præmerso.*"

* "Deinde præcipe ei, ut radi faciat caput suum cum novacula. Deinde fac eum sedere inter manus tuas quadratum, ita quod iam posuit manus suas super pectus suum. Deinde po ne radicem palmæ tuæ super radicem nasi sui inter oculos suos. Ubiq. ergo pervenerit digitus tuus medius, signa locum illum cum incausto."

"Et dixerunt quidam eorum, ut cauterizetur cutis usq. ad os; et teneatur cauterium, donec aduratur quiddam spissitudinis ossis. Deinde radatur post illud quod ad ustum est ex osse, deinde curetur."

praised by Galen * most partially, “velut sceptrum quoddam,” as a kind of sceptre with which they subdued hæmorrhages and reigned over diseases; and the provinces which were held in subjection by this fiery sceptre were of no small extent; there was hardly any disease which fire could not cure! the chapters on the use of Cauteries in the surgery of Albucasis are just fifty-eight in number; and the diseases enumerated are, leprosy, dropsy, and almost all that the human body is subject to! Albucasis seems to have been in the custom of chastising and chafing all rebellious pains from hip to hanch with this powerful sceptre. He directs how to cauterize every individual part of the body †, from the head to the heel, “a capite ad pedes,” maintaining his practice by very suitable doctrines ‡.

At the revival of learning, when the physicians of Europe were as yet little acquainted with natural science, they merely transcribed their lessons in medicine from the Greeks, Romans, and Arabians, and rested entirely upon authority. Then every thing ancient was sacred; they began indeed to find out other cures for ordinary diseases; but hæmorrhages they opposed only with the heated iron, which was still the sceptrum ad restringendum fluxum sanguinis. The learned of those times were worshippers of fire; and those who seceded from this great doctrine were regarded as hereticks, as ignorant men, incapable of understanding the writings of the ancients, or of relishing their doctrines, and were hardly accounted as regular physicians. It was this deference for authority that supported such unnatural and cruel practices; and it was by the learned physicians of France that Parée, the inventor of the needle and ligature, was so hardly used. They considered the hot iron, not as a mere cautery, but as an astringent; and actually believed that they improved the astringent power of their cauteries by heating and quenching them from time to time in red wine or strong vinegar! In those days the metal of which cauteries were to be formed, the degree of heat that was to be used, and the very shape of this sceptre,

* Galen in Therapeuticis.

† “Et ego quidem jam ordinavi hoc Capitulum in Cauterio, secundum capitula: et ordinavi ea a capite usq. ad pedes: ut allevient quærenti illud quod vult ex eo.”

‡ “Dico ergo, quod cauterium confert universaliter omni complexioni, que est cum materia, et absq. materia; exceptis duabus complexionibus, quæ sunt complexio calida absq. materia, et complexio sicca absque materia. In complexione autem calida et sicca cum materia dissenserunt. Quidam enim dixerunt, quod Cauterium juvativum est in ea. Et dixerunt alii contrarium illius, scilicet quod Cauterium non est conveniens in ægritudine, que est ex caliditate et siccitate: quoniam natura ignis est caliditas; et inconveniens est, ut sanetur ex ægritudine calida et sicca,—cum calido et sicco!”

became important disputations. Albucasis had protested against the usage of the ancients and of Avicenna, who made cauteries of gold. Albucasis ordered the cautery to be heated to a white heat, (*igneatur in igne dovec rubeat et projiciet Scintillas*), a degree of heat which gold could not so well bear *. The more modern surgeons, in searing arteries with the heated iron, could not but observe that too hot an iron made a sudden eschar, which fell off as suddenly; they objected to gold, because it did not indicate the degree of heat, and preferred iron, which marks the degrees of heat by the various colours it assumes. They were thus careful to regulate the degree of heat, because when they applied the cautery too cool to the mouth of an artery, there was no eschar formed, and it continued bleeding; when they applied it too hot, the slough or eschar was apt to yield to the beating of the artery, and to fall off almost as soon as the cautery was withdrawn.

It was in those times that the invention of a new cautery, or a new shape for the iron, was thought meritorious. It was then, also, that Fabricius ab Aquapendente, published his new method (which he claims as peculiarly his own) of cutting off a cancerous breast: "If it be a moveable cancer, I cut it away," says Aquapendente, "with a red hot knife, which sears or burns as it cuts; but if it be a cancer adhering firmly to the thorax, I cut it, without either bleeding or pain, with a wooden or horn knife soaked in aquafortis, with which, having cut through the skin, I then do the rest by digging out the gland with my fingers †." These are methods really deserving of the encomium which Mr. Dionis put in the author's name. "They have chiefly the merit, says Dionis, of hitting two birds with one stone." *On ferait d'une pierre deux coups ‡.* Guy de Chauliac writes both historically and critically on this very point. The cauterizing irons were of various forms (says he) among the ancients, but the moderns have limited their number. "William of Salicetus has but six or eight

* *Liquefcit in igne ut vertitur in laminas.*

† *Ego autem, etsi nil tale facere molitus sum, si essem facturus, ut dolorem primo vitarem, et saniei profusionem, si cancer sit mobilis, ipsum forcipe hoc apprehenso statim cultro, uno eodemque tempore candente et incidente opus peragerem, ut forcipe valide constringente sensus partes hebetur, cultro incidente amputetur cancer, et eodem candente sanguis supprimatur. Quod si cancer mammillæ adherens et firmus sit, neque stringi possit, excedendus omnino est, atque ad vitandum et dolorem et profusionem, excederem cum ligno aut cornu, aciem habente intincto tamen subinde in aqua illa, qua aurifices ab argenteo aurum separant, quam fortem vulgus nominat, quo tota cutis in circuita mammillæ incidenda est, postea digitis potissimum et unguibus mammillæ glandulosa substantia à subiecta parte separanda."*

‡ Dionis, page 362.

forms of the cautery. Henricus has seven only ; Lanfranc has ten ; but I myself have only six different irons !” a precious employment indeed for Gulielmus de Salicetus, Henricus Lanfranc, and Guido de Cauliaco, counting their burning irons *.

Without reading the books of the old surgeons, it is not possible to imagine the horrors of the cautery, nor how much reason Parée had for upbraiding the surgeons of his own time with their cruelties. A number of cauteries were heated in the fire at once ; they were usually of a conical form, so as to enter into the wound, and touch the mouth of the artery, without hurting much of the surrounding flesh ; they were brought from another room, for the surgeons were careful to hide this apparatus. They first struck the cautery against the side of the grate, and then rubbed the face of it upon the floor. They clapped the point of the forefinger upon the mouth of the artery, twisted it round and round, and took a second and a third iron, when the first cooled. They turned and whirled the cautery thus round upon the mouth of the artery till the blood stopped ; and in deep lying arteries they pushed strongly upwards in proportion as they twirled the cautery round ! seeking to bury the artery deeper among the flesh. They were careful not to dress the wound till the third or fourth day, lest the eschar should fall off too early. I believe that more dexterity, and certainly more hardihood, was required in performing these operations than in using the needle †.

* “ Instrumenta quibus fiunt cauteria actualia apud antiquos diversa erant moderni, vero ea retraxerunt ad eorum numerum ut Gul. de Salicetis, ad sex vel octo ; Lanfranc ad decem Henricus ad septem ; ego vero Cauteria Communia faciebam cum sex formis.” Guido de Cauliaco.

These various shapes of the cauteries are to be seen in the chapter of burning irons at the head of this chapter.

† “ In using the actual cautery the surgeon should be always furnished, of several sorts, larger and smaller, with button, flat, and pointed extremities, for the better adapting them to the mouths of the vessels, without hurting any adjoining nervous or tendinous part. As to the use of which there may be more judgment required than the younger artist is aware of ; for if *perfectly red, or fire hot*, as we call it commonly, hastily applied and instantly removed, it is odds but at the same time the *eschar or crust is pulled off with the iron*, and the patient undergoes the pain to no purpose, the vessel now again bleeding as forcibly as ever. When the same then is of a moderately glowing heat, being struck against the grate, or side of the chafing-dish, where the burning charcoal is kindled for that purpose, and rubbed against the floor ; let it be *strait clapped up to the mouth of the artery, carrying it however sideways to the same, that the blood flowing out against or upon it, may not damp the heat* : At the same time let the end of the cautery be turned two or three times round about against the bleeding part, with expedition ; still observing upon each touch, whether the work is done complete, whence you may renew or withdraw wholly your instru-

The horrors of the patient, and his ungovernable cries, the hurry of the operator and assistants, the sparkling of the irons, and the hissing of the blood against them, must have made terrible scenes, and surgery must in those days have been a horrid trade *.

For one wound, and especially for the amputation of a limb, many cauteries were required. Parée, in his spirited reply to Gourmaline, says to him, "If, Sir, in a siege, or in the assault of a city, where hundreds of soldiers have their limbs shattered, you should choose to cauterize with burning irons, you would need a page to run backwards and forwards with your irons, and furnaces to heat them in; and I should little wonder, if, in the end, you were to be dragged out and stoned, as happened to Agatheus, one of the earliest surgeons in Rome †."

From actual cauteries it was natural to proceed to use substances which had a similar operation, as caustics, stimulant applications, and hot oil; and as these took place of the heated irons, it was natural to call them *POTENTIAL CAUTERIES*; in this rank were many fluids, which had no other effect than as they were hot; even melted sulphur was used, and melted lead, and boiling oil, the temperature of which is equal to melted lead; but the boiling oil of turpentine, was the favourite application. Kettles of boiling turpentine were kept in readiness in the cock-pit during a battle at sea, and in hospitals where great operations were to be performed; but their chief potential cautery was blue vitriol, which was applied in the following manner: The vitriol was pounded grossly (not very small), it was wrapped up in a linen rag; this little bundle, ment, conveying the same, as it was brought you, handsomely out of your patient's sight, and dress up with lenients, as is required in other ambuitions."

"But where the artery, although its impetus be taken off, continues bleeding after this, you may give the eschar a touch more, or the heat decaying and proving insufficient, having a second iron always ready in the fire in another room, or behind your patient, in the chimney of the same; therewith finish what remains, observing the same in the application of the first."

* "Your patient, says Turner, especially if a woman or child, or a woman with child, should never be suffered to see your irons, or, if possible, to know any thing of them; for which end it is necessary that the face be covered at such times, and the part held steady by a servant, or some proper assistant, among which some of your own fraternity are the fittest." Page 528.

† "Ioinct que si aujourd'huy apres un assaut de ville où plusieurs soldats ont eu bras et jambes rompuës et emportées de coups d'artilleries, ou de coutelas, ou d'autres machines pour estancher le sang, vous falloit user de fers ardans, il faudroit pour ce faire une forge et beaucoup de charbon pour les chauffer, et aussi que les soldats vous auroient en tel horreur pour cette cruauté, qu'il vous assommeroient comme un veau, ainsi que jadis fut l'un des premiers chirurgiens de Rome."

like a waistcoat button, was what they called a button of vitriol; and the blood being for a moment suppressed by the tourniquet, this vitriol button was placed carefully upon the mouth of the wounded artery. The tourniquet was let go, after some interval of time, and very slowly. The exuding of the blood dissolved the vitriol slowly. This caustic affected the artery, made an eschar like that of the actual cautery, which fell off after some days. The same precautions of unscrewing the tourniquet slowly, &c. were used in dressing the wound, which was seldom opened up till the fourth or fifth day.

We are to judge of these cauteries, boiling oils, vitriols, corrosive sublimate, and other caustics*, not by the horrors of the operation, nor the transitory pain of the moment, but by future consequences, for the patient was continually exposed to hæmorrhagy. The eschars might loosen too early, and of this accident, and of the sudden hæmorrhagy which followed, thousands died; while few escaped a dangerous loss of blood, and repeated cauterizing for many successive dressings. In wounds, the bones and tendons were exposed, the muscles wasted, and the arteries themselves sloughed to a great extent, bleeding as long as the patient's blood retained any colour. And in amputations, the flesh was wasted, the bone projected, and the stump was pyramidal and could not be closed. Is there any wonder that the discovery of some styptic or effectual astringent of the vessels was greatly desired? or that the meanest pretender attracted notice? or that those few medicines which suppressed hæmorrhagy, though but in a very imperfect degree, procured for the inventors public rewards?

The transition was natural, from corrosive sublimate, caustics and vitriols, to the milder metallic solutions, which then lost the name of potential cauteries, and were obtruded in various disguises under the title of Styptics and Astringents. The chief styptics have been acids, solutions of vitriol, turpentine, and various solutions of astringent gums in spirits of wine. These were invented by the regular physicians, and had their successes in slighter hæmorrhages; and always the hope was indulged of finding out some astringent sufficiently powerful to suppress even the bleeding from an amputated limb. This easy and credulous temper of mind in men of our profession has left the public very much exposed to the practices of quacks. We know by long experience, and many disappointments, the insignificance of those drugs which have been produced

* We are told in Young's *Currus Triumphalis*, of nineteen men being cruelly destroyed by using corrosive sublimate for restraining the hæmorrhagy.

from the vegetable or mineral kingdom to serve as styptics ; we know them to be of little use farther than to check any slight bleeding of the nose or gums. We no more expect any acid, spirituous, or saline body to act as a styptic without causing pain, than we would expect Digby's sympathetic powder to act at the distance of many leagues. We know that the chief secrets of empirics have been the neglected inventions of old physicians. We have never heard of any styptic which was not proved in the end to be a solution of vitriol, or a spirituous solution of some astringent gum !—What should we expect from the random inventions of ignorant people, whose sole trade is that of cheating the public, and whose only skill is that of contriving and managing the deceit ? From the time of Rewbell to the celebrated Ruspini, we have found disappointment following quick after each fit of expectation ; and though many attracted, by the prospect of public rewards, have imposed for a little while ; though their styptics have for a day borne an inestimable value, yet always the charm has vanished with the secret ! Such styptics have no sooner been bought by the King and Parliament, and publicly prepared ; they have no sooner been dignified with the high sounding titles of Royal Styptics, Aqua Styptica Regalis, &c. &c. than they have been rejected and despised.

Rewbell was a German chemist, and, having gone up to Paris with his styptic, he so wearied the King, and Mr. Louvais, with entreaties and solicitations, that, after long attendance, he obtained leave to use it upon one of the soldiers in the Hospital of Invalids. This poor man's leg having been amputated in the usual form, the surgeons and physicians of the hospital delivered him up to Mr. Rewbell, who had hardly finished the first application of this styptic, before the blood came draining through all the dressings. He doubled the dose of his styptic water, dressed his stump firmly a second time, but still the blood flowed * ; so that in a little while, and in presence of all the assistants, the unhappy subject of this cruel trial died under his hands ; either they had not had that fear, which they should have had for the patient's life, or they wanted humanity or resolution enough to stop this horrid experiment ; but they made some amends by procuring an order from the King, prohibiting Rewbell, under the severest penalties, from repeating this attempt.

We have seen the latest of these inventions, Ruspini's styptic, tried in this

* This Eau de Rabell, so famous in France and Germany, was just a mixture of strong spirit of vitriol and spirits of wine.

place, where I believe it is esteemed as of much the same value with the sympathetic powder of that famous knight, and most complete gentleman, Sir Kenelm Digby; which sympathetic powder staunched the blood, as effectually when it was applied to the weapon, as when applied to the wound itself*.

This country has never been behind hand in credulity, nor in public liberality. About sixty years ago, Turner observes, "That among liquids there are blood-staunches of great variety, every empyric now boasting of an infallible styptic."—"In the reign of King Charles the Second, Mr. Denys's Effence made great noise among us, many experiments being tried therewith by Dr. Walter Needham and Mr. Richard Wiseman, as well on brutes as human bodies, several of the court physicians and principal surgeons being present, the King himself also a spectator at some of them, and declaring his satisfaction in the same; upon which Monsieur Denys was desired (but not without a princely reward) to communicate his secret, which was prepared in the Royal Laboratory, and after used with very great applause, under the title of STYPTICUM REGIS; yet quickly after the secret taking air, the same began to be overlooked, and little set by, which put another Secret-Monger upon publishing one not half so good, as was proved by that faithful and judicious practitioner Mr. Cowper, in the hospital of St. Thomas, Southwark; who, notwithstanding the differing character given it by the author, declared it a most painful and violent caustic, at the same time ineffectual in the end of its application."

"However, when our people had run a-madding some time after this new lunary, a purchaser was met with (much good may do him with his bargain) on whose hands, I doubt, the commodity goes heavily off, especially since another wonder-working-whim for the same intention is put up to a sale; which, notwithstanding a quondam first rate physician has been fautor thereunto, I must do that

* This I believe is the same knight, whose gallantry and loyalty carried him to such excess, that he burst the arteries of his legs, so as to form aneurisms, by kicking open the doors of the den, in which the boar was confined which the king was to hunt: but whether his aneurisms needed to be opened, or whether he used his sympathetic powder, or whether he applied it to the door, or to his own hams, the German writer who tells this story does not declare.

"Vidi equitem Digbeum, amicum intimum, egregium philosophum, chimistam, cujus præscripta medica curiosa typis mandata Parisiis, a Trefelio mihi dicata fuere; exortæ illi fuere venæ et arteriæ variceformes in tibiis, cum pedum impulsu conaretur infringere fores septi ferarum, quibus Rex Angliæ adstabat, quocum venatum ibat: Forte contigit in eo occurfu et tunica arteriarum media crepuerit, ipsa autem arteria admodum dilatata; tunc temporis tumor longitudinem arteriæ insequitur, in extensione vim patientis."—Zodiac. Med. Gall. p. 45.

justice to the public, to declare, in those few trials I have made therewith, I found it what the people call a chip in pottage; and, I fear, whoever shall lay a stress on the same in amputation, or restraining any forcible hæmorrhage from the arteries of human bodies, especially the adult, *will be found to do little better than trifle with men's lives.* The first time I had sight of this medicine, and tried it upon my tongue, I was absolutely certain it was a solution of steel, which was farther confirmed by some other trials I made use of*.”

Societies for the improvement of natural science had been established in England and France; and it was well known that the discovery of a good styptic was a benefit for which the public would not be ungrateful; and that any invention worthy of the patronage of those societies would ensure the Royal bounty.

It was about the end of the year 1750, that Mr. Brossard, a surgeon in Berry, went up to Paris with the hopes of selling a remedy, which he said was perfectly effectual in stopping, not only the hæmorrhagy of wounds, but that of an amputated limb. At his request a committee of the Academy of Surgery being appointed, he performed in their presence many experiments upon dogs and other animals. The most perfect successes of this kind could not be considered as decisive, because dogs and lesser animals never die of such bleedings; but they were such as to entitle the academicians to allow of bolder trials†. He was allowed to try his remedy in the Hospital of Invalids, where he perfectly succeeded in stopping the hæmorrhagy, after an amputation of the leg; and Mr. Faget having two patients in La Charité, with legs much crushed by a waggon loaded with stones passing over them, he amputated both legs, and in both Mr. Brossard suppressed the bleeding. Both of them died some days after, but not of hæmorrhagy‡.

* Turner's Surgery, page 338.

† “Trials of styptics on the bodies of quadrupeds have been commonly practised to commend them to the public; but it is not without cause that pretenders to such remedies have made choice of younger animals, as dogs and calves, &c. for that purpose. But since the only standard for their use is their success on human bodies, we ought to make our experiments on those animals, whose magnitude and age bear a proportion to it; for nothing is more obvious in wounding the arteries of living animals, than that the protrusion of their blood bears a proportion to their bulk; and in dissection, the arteries of the fœtus are remarkably thinner than those of an adult, and those of an aged person grow still thicker, and frequently become cartilaginous, and at length entirely bony, of which Dr. Tyson and myself have several pieces.” Cowper.

‡ The one died on the 5th, the other on the 9th day. The arteries were so contracted near their

This invention of Mr. Broffard's was the agaric of the oak*, a fungus which grows upon the oldest trees; it is gathered in August or September after the greatest heats; and it is prepared by long keeping in a dry place, by cutting away the outside rind, and beating it till it soften, so that it begins to yield and can be torn with the fingers; it is of the colour and appearance of shamoy leather, and in the country parts of Ireland it is actually called oak leather. It was cut into small pieces, which (the tourniquet being firm screwed) were fixed upon the mouths of the bleeding arteries, were supported by compresses, and bound firm down in the wound, or upon the face of the stump, by a fillet, which was passed up along the limb. It succeeded often in the hands of Messieurs Faget, Bouquot, Morrand, and other great surgeons of Paris.

Though the use of the agaric in hæmorrhages had actually been mentioned by Felix Wurtzius a hundred and fifty years before, yet Mr. Broffard was liberally rewarded by his Most Christian Majesty. Pieces of prepared agaric were sent, with a respectful letter, from the French Academy to our Royal Society, by them it was committed to Mr. Warner, who made various experiments with it, generally successful; and he closes his remarks with this sensible observation, That the agaric is still more useful in old and ulcerating wounds, and in stumps where the rottenness of the flesh prevents the needle being used, than in amputations, or recent wounds. This discovery was thought to be perfect. Mr. Faget, in his enthusiasm, believed that the needle was to be superseded by the agaric; the discovery was in this country also a subject of great exultation. The virtues of the agaric were equally extolled in the French Memoirs and in our Philosophical Transactions; it was reckoned to be not merely a sponge, but an astringent, having very singular properties in contracting the vessels; and one Societarian, suspecting that it might be equally useful in internal hæmorrhages, BOILED IT†,"

mouths that Mr. Faget could hardly introduce the smallest probe into them, which gives occasion to a very fine dissertation, of no inconsiderable length, upon the power the agaric possesses of causing arteries to contract.

* The names of it are, Amadou, agaric of the oak, fungus orbicularis, fungus igniarius, or touch-wood, lycoperdon, bovis, vessie de loup, agaric de chene, mullipuff, puff ball, &c.

† The chief papers, upon this subject of the use of the fungi, as puff ball, agaric, fungus vinosus (a fungus that grows in wine cellars), &c. may be seen in the Philosophical Transactions, or in the Academy of Sciences, about the year 1756; and there will also be seen, some indications of the confused notions they had about these fungi; considering them not merely as sponges, but as containing some hidden inexplicable virtue in restraining hæmorrhages; this is best understood by the experiments of one man, who resolving to be very wise,—or like a true SOCIETARIAN—(as Dr. Hill would have said), BOILED IT!! "I

like the German peasant, who, in place of carrying the doctor's prescription to a laboratory, rolled it up and swallowed it *.

Yet in using the agaric much depended on the manner in which it was supported! on the tourniquet being kept firm till it had adhered, on the tourniquet being slowly let go, on the neat compresses which were held over it, and on the bandages with which the whole was secured. With every precaution it did fail sometimes. Warner, after the flattering reports which he at first gave of it, trusted too much to it in an amputation of the thigh, where it failed; it failed often in the hands of the most able surgeons; it fell at last into disuse; and the least that we can say of this discovery, so hyperbolically praised, and so highly rewarded, is, that had it been invented in the days of Celsus, when they were cutting off limbs, not with the assistance of the tourniquet, but by the gripe (i. e. by assistants grasping the thigh), when they were searing the arteries with their burning irons! it must have been of infinite value, and have saved many lives; but coming as it did in competition with the needle, it must have delayed the general use of the needle, it must have endangered many lives, and was in no respect worthy of the high praises bestowed upon it by the Academy of Surgery, nor of those liberal rewards which the King of France bestowed upon Mr. Broffard. The privilege of rewarding merit is a high one; but I fear that such rewards are rather a general bribe, for the concealing of useful inventions; while an invention really useful, will always be in the same degree honourable; and, in our profession, will reward itself.

The SPONGE, which has been used chiefly by the celebrated Mr. White, is more useful than the agaric; it is like it in its operation, is really of value in practice, not to take the precedence of the needle, but to assist it. The sponge

have tried it, says this gentleman, in female cases, with *great success*, by injecting a STRONG DECOCTION of this fungus into the womb, in hæmorrhages from the womb, and especially in fluxes, after delivery." Vid. Philosophical Transactions, p. 265.—He had better have injected a STRONG DECOCTION of Album Græcum.

* The story is told by Densingius. "Dr. Nicholas Müller having written a prescription for a country fellow, desired him to divide it into three equal doses, very accurately, and take one every morning in a cup of ale; the poor fellow's head ran on nothing but charms and incantations, and he considered Nicholas Müller as a being very superior to a mere doctor. In a few days the man returned with a hen's egg in a basket, as an offering to the doctor. Müller now perceiving the extreme simplicity of the fellow, asked him whether he had taken the medicine faithfully? very faithfully, says the clown, I tore it into three pieces, as like one another as pease, and took one every morning fasting; and now, thank God and your Honour's goodness, I'm pure well."

can be very thoroughly dried, it can be compressed into a very small compass, it can take any shape, and may be thrust down into cavities and narrow wounds where the needle cannot go; it can be made so hard, and pressed so firm by laying compresses over it, as to have at once the effect of a compress and of a sponge; or rather of a compress having this curious property, that at first it presses moderately, but if one drop of blood escapes, the compress swells by absorbing that blood, still preserves its contact with the bleeding artery, and swells more, and presses harder, exactly in proportion as such pressure is required. This is plainly the effect of a sponge, whether it be nitched in betwixt two bones to compress an artery which the needle cannot reach; or whether it be laid flat upon an open sore, as after cutting out the breast; or after an amputation done according to the old fashion, where the surgeon used to dress his stump open, and to heap compresses tied with a firm bandage above each piece of agaric or sponge. The agaric possessing a degree of this property is of use; even our common lint possesses this quality of absorbing and swelling in a slight degree. But the agaric and sponge are both so excellent in this respect, that even those who are the least inclined to use them, must acknowledge, that though the agaric will often fail, it has yet enabled surgeons to perform the greater amputations safely. And the sponge, as is proved by Mr. White's Practice, is the only thing that can stand by the side of the ligature to assist it. I am sensible, that by thrusting down a sponge I have saved a patient's life, when I could not have extricated myself by any nicer operation.

I am next to explain to you the discovery of the needle and ligature for stopping arteries, a discovery which has raised Paræus to a rank not inferior to that of Harvey, which nevertheless has been neglected for nearly two hundred years! Shame to successive generations who have disputed about its merit, who have vilified the author, condemned his invention, and prevented the improvement of their own science. This unwillingness to use the needle proceeded from the jealousy and literary pride of the physicians of those times. Delighted with the absurd learning which they cultivated, and attached to their Greek, Roman, and Arabian masters, they were worshippers of the ancients, and of their doctrine of fire. They were intollerant and revengeful; they claimed to be the legitimate representatives of the old schools; they would rather cauterize arteries with the ignorant and brutal Albucasis, that Arabian farrier, than tie them with Parée, the first surgeon of Europe, their contemporary.

Paræus was body surgeon to four successive kings of France. His talents for his profession were excellent. He had been diligent in anatomy; he had lived in the Hotel Dieu for three years; and, in the turbulent reign of Henry the Fourth, he was in every scene of danger. He was indefatigable in his profession; he was proud of it; he maintained it against the College of Paris. His high fame descending thus for ages, must make you desirous of knowing the real character of the man; and there is no one point upon which his character turns so much as this single invention: for of all his improvements, this of tying arteries was that of which he was proudest; he says, with the true enthusiasm of genius, "For the good of mankind, and the improvement and honour of surgery, I was inspired by God with this good thought." And as it was the highest of all his improvements, it was that for which his enemies envied him the most.

The fortune of Paræus was very singular; he was at once the chief surgeon, the counsellor, and the private and familiar friend of four successive kings of France. He attended them in their retirements and looser hours; he followed them in the field, through all the dangers which were in those days part of the duties of a king; and which his writings display to us, with a faithfulness and a minuteness of description which the historian should hardly disdain. He had the good fortune on one occasion to save manifestly the life of the king, when his arm had been so hurt in bleeding, that it was three months before Paræus could accomplish the cure. He was a man of such rare abilities, and so much valued by the king, that he alone was saved alive in that horrid massacre of St. Bartholomew's day, which remains an eternal blot upon the French name.

But of all his good fortune, this is the most remarkable, that it was he alone, who, by his influence over the king, put a stop to this unparalleled butchery, after it had continued in all the quarters of Paris during two days.—The horrors of the king after those dreadful days of carnage and most sacrilegious murder, and the familiar and even tender manner of his complaining to Paræus, are told by the Duke de Sully very feelingly! for Sully was himself of the Reformed religion, and though yet a child on the day of the massacre, escaped with difficulty.

* "The hour is now come, said the king, when all France shall be of one re-

* "Que ce Prince lui ayant dit le jour du massacre, qui c'étoit à cette heure, qu'il falloit que tout le monde se fit catholique. Parée lui repondit sans s'étonner: Par la lumiere de Dieu, Sire, je crois qu'il vous souvient m'avoir promis de ne me commander jamais quatre choses; sçavoir, de rentrer dans le ventre de ma mere, de me trouver a un jour de bataille, de quitter votre service, et d'aller à la messe." Le Roi

ligion." " Now, by God's light, Sire, (replied Paræus, nothing alarmed), I think you will never forget your promise to me, that there was four things you would not force me to do:—To enter again into my mother's womb;—to go out in the day of battle;—to leave your service;—nor, to go to mass.—The king then took him aside, and opened up to him the troubles with which his soul was disquieted. " Ambrose, says he, I know not how it is with me, but it goes so heavily, that within these three days I am as in a fever; indeed I am ill, in mind and in body; sleeping or waking, the murdered Huguenots are ever before my eyes, with hideous faces weltering in their blood. Would to God the children and the aged, at least, had been spared!" The order for stopping the massacre, which was proclaimed the following day, was the result of this conversation.

There had long been an open war, about privileges and dignities, betwixt the surgeons and physicians; and that was one cause of settled malignity and discontent *. That Paræus, a surgeon merely, should venture to write so large a book on surgery, and should make it, according to the grotesque taste of that age, a good and learned book, was high matter of jealousy and offence, and for this reason was Paræus accused of ignorance in the Latin language, and of hiring young physicians (as if young physicians should be more capable in surgery than old surgeons), to write his books. That Paræus's abilities should have raised him to stations of honour, or made him thus familiar with a race of princes not too apt to condescend, was a sore grievance to all his enemies, or which is the same, to all the physicians; but more especially, to such a man, and such a physician as Gourmaline, whose taste in learning and in manners, and whose habits of mind, are best explained by the language with which he assaulted Paræus.

" It was then very forward, rash, and presumptuous in a certain person, to venture upon condemning the cauterizing of bleeding vessels (after cutting off a mortified limb), a method so highly and continually commended and approved

le prit a part, et s'ouvrit a lui sur le trouble dont il se sentoît agité. " Ambroise, lui dit-il, je ne sçais ce qui m'est survenu depuis deux ou trois jours; mais je me trouve l'esprit et le corps tout aussi emus, que si j'avois la fièvre. Il me semble a tout moment, aussi bien veillant que dormant, que ces corps massacrés se présentent a moi, les faces hideuses et couvertes de sang; je voudrois bien qu'on n'ey eut pas compris les imbeciles et les innocens." L'Ordre qui fut publié le jour suivant de faire cesser la tuerie, fut le fruit de cette conversation."—Sully, Liv. I. p. 3.

* By your good will (says Paræus to one of those persecuting physicians), by your good will, Sir, I think you would not have a surgeon even to order a simple poultice. Vid. page 781.

of by all the ancients ; teaching in opposition to that, without any authority, without knowledge, without experience, without good sense, some new method of his own, of tying arteries and veins." And in the end, he proceeds to call him carnifex, and other names, which it is needless to repeat *.

These were persecutions which the College of Paris was not ashamed to avow. They claimed the privilege of licensing books, and ordered this public prosecution of Paræus by their president Gourmelen. They would have suppressed this method of tying arteries, so heterodox did it appear in their eyes, and so entirely opposite to the methods of Galen and Celsus. They won their cause, but Parée declined the authority of the Parlement ; asserted the privilege of his own profession, it was however only by advocating his cause that he succeeded ; for he appealed to the Court, and it was by a violation of the usual forms that he was enabled to publish his book †.

Not satisfied with the licensed atrocities of Gourmelen, whom they had appointed to prosecute Paræus in the courts of justice ‡, the College set upon him another hound of the same pack, one B. Comperat de Carcassone, a pupil of Gourmelen, more malignant, dull, and wicked, if possible, than his master. These physicians pretended to despise Paræus as an ignorant man ; and behold this Comperat, Gourmelen, and the very College they belonged to are remembered only by their invidious persecution of Paræus. They contrived to fasten upon him

* Male igitur et nimium arroganter, inconsultus et temerarius quidam, vasorum uisionem post mortui membri resectionem, a veteribus omnibus plurimum commendatam et semper probatam, damnare ausus est : novum quendam deligandi vasa modum contra veteres omnes medicos sine ratione experientia, et judicio, docere cupiens, nec animadvertit majora multo pericula ex ipsa vasorum deligatione (quam acu partem sanam profunde transfigendo, administrari vult) imminere, quam ex ipsa uisione.

† " Les Docteurs en Medecine de Paris, voulans maintenir le droit, qui leur estoit acquit par un arrest notable donné le second jour de May mil cinq cens trente-cinq, Monsieur le President Lizet seant, portant defenses à rous les subjects du Roy de ne faire imprimer, et à tous Libraires ou Imprimeurs de n'imprimer aucuns liures en Medecine, qu'ils n'eussent premierement este veus, visitez, et approuvez par les Docteurs en Medecine de Paris, donnerent charge à Monsieur Gourmelen, qui estoit leur Doyen, de prendre garde que tel Liure ne fut mis en vente, que premierement ils n'en eussent donné leur avis, pource qu'ils estoient bien assurez que telle marchandise ne pouvoit fortir du Magazin de M. Ambroise. Monsieur Gourmelen, pour s'acquitter du deuoir de SA CHARGE, Y EMPLOYE TOUS LES MOYENS DESQUELS IL SE PEUT ADUISE : tellement que M. Ambroise, qui craignoit la censure des Docteurs en Medecine, fit tant par ses menées qu'il fit playder la cause devant le cour de parlement."

‡ " Il a este picqué de ce que la faculté de Medecine a la pursuit de Mr. Gourmelen, lors doyen de la dite faculté c'estoit opposée a la publication de ces Oeuvres en Chirurgie, devant qu'elle en eust donné son avis suivant les amieus arreits de la cour de parlement, &c.

the most injurious accusations: "He was not contented," says Comperat, "with teaching surgery, but entered also into the highest points of philosophy: yet I will correct myself, says Comperat! He entered into no such high points of philosophy and medicine; he bought these dissertations of various learned men, and had them translated into Latin, in order to make exhibition of his learning to foreign nations."

What were these highest points of philosophy which Paræus was accused of meddling with? The points of philosophy are admirably enumerated, indeed, by this very Comperat. He discoursed (says Comperat) of elements, temperaments, humors, faculties, actions, and nervous spirits,—of sperm, and blood-menstrual; and of the causes and signs of conception; and of the formation, motion, and completion of the fœtus *." But who was it that disgraced the books of Paræus with this wretched affectation of learning? The physicians of Paris, whom he had very unwisely employed to adorn his book, which they performed in such a style that it looked more like the work of the learned College and Dr. Gourmelen, and his pupil Comperat, than of the manly and sensible Paræus.

"Had Paræus composed his Cases without the help of physicians, and published his surgical operations and consultations, and all the fruit of his experience, in one small volume, his fame, like that of Hildanus, would have gone down unblemished to the latest posterity †." But his observations are scattered, through the monstrous Folios of those hireling physicians; and yet

* "Il voulut entrer en discours des hauts poincts de Philosophie et Medecine, comme des Elemens, temperamens, humeurs, facultez, actions, esprits, pour introduire le jeune Chirurgien en la connoissance de la Chirurgie: comme s'il luy estoit necessaire pour entendre les beaux poincts de sa profession d'entrer en consideration des hauts mysteres de la Philosophie naturelle. De mesme il fait pour luy apprehendre à tirer le petit enfant du ventre de sa mere, quand telle occasion se presente, discourant du sperme, du sang menstrual, des causes et signes de la conception, et des diuers temps esquels l'enfant reçoit sa figure, son mouvement, et son accomplissement."

† "Ponam in prima acie Gabrielem Fallopium, qui tamen et ipse ad lyram Guidonis saltavit." "Huic subjungo Ambrosium Paræum, sed qualem virum! Regum Galliarum, Chirurgum petitissimum, qui ipso rerum usu, gravissimorumque casuum occurfu edoctus, artem valde locupletavit: interim scire oportet, ingens illud volumen, quod ipsius nomen in fronte gerit, ab aliis Medicinæ Doctoribus Parisiensibus concinatum fuisse, quibus amplam segetem exemplorum Chirurgicorum Paræus suppeditavit, quibus alii formam induxerunt; imo, ut in majorem molem opus excreceret, *multa superflua et a Chirurgico instituto aliena adjunxerunt*. Profecto melius expertus ille vir suæ famæ consulisset, si singulares curationes et rariorum affectuum observationes, atque remedia, infallibili usu et tot annorum experientia ipsi comprobata, parvo volumine comprehensa edidisset in lucem: ut fecit sane, magna cum nominis sui gloria Guilelm. Fabr. Hildanus, Germanorum decus eximium, et cujus famam fera posteritas loquetur."—MIKPOTEXNH. 526.

that salt, so sparingly sprinkled, has preserved the corruptible mass for nearly two hundred years. These learned compilers have made his book, what it is, a System of anatomy, a Compendium of surgery,—a Dispensary of drugs, chemical and Galenical,—a collection of cases,—and a history of travels and voyages, by sea and by land! By them has the text of Paræus been adorned with the most incredible tales! and the margins of his book with the most uncouth drawings of birds and beasts, and comets, and monsters, and men-monkeys, and women-fishes! Never till then was the monstrous composition which Horace derides, actually and unequivocally fulfilled:

“ Humano capite cervicem pictor equinam,
Jungere si velit et varias inducere plumas;
Undique collatis membris ut turpiter atrum,
Definat in piscem mulier formosa superne.”

In his Voyages we find pictures of the Whale, and the Crocodile, and the Haiit and the Hufpalin, and such extravagancies, that it is difficult to conceive how the various monsters could be imagined even by the most disordered brain. But all this has nothing to do with the surgery of Paræus! this is the work of the young physicians, the compeers of Comperat and Gourmelen! this is their learning! they have made this book of Parée's a Mare-Crisium*, an ocean of monsters, for such writers as Licetus to take their sport therein.

Parée, familiar as he was with kings and princes, was not to observe the strictest rules of decorum with such antagonists as these. In the answer which he made to these heavy charges, we perceive, along with his sharp reproof of Mr. Gourmelen, (mixed as it is with indelicacies, which the fashion of the time gave countenance to), the natural good sense, and the right education of Paræus, and the true grounds on which his character was founded, which he explains to us with a confidence and steadiness well becoming such a man †.

“ You boast moreover, Mr. Gourmelen, that you will teach me my lessons

* The Mare-Crisium is an imaginary sea in the Moon, so named in all the Maps of that Planet.

† Davantage vous dites, que vous me montrerez ma leçon aux opérations de chirurgie; il me semble que ne sçauriez, parceque je ne l'ay pas apprise seulement en mon estude; et pour avoir ouy par plusieurs et diverses années les leçons des docteurs en medecine: mes comme j'ay escrit cydevant en l'epistre au lecteur, j'ay fait residence en l'Hotel Dieu de Paris par l'espace de trois ans, ou j'ay eu moyen de voir et apprendre beaucoup d'œuvres de chirurgie, sur une infinité de malades, ensemble l'anatomie sur une grande quantité de corps morts, ainsi que souvent j'en ay fait preuve tres suffisante publiquement aux escoles de medecine de Paris,” &c.

in surgery, and my operations ; but in that I believe, you are a little mistaken ; for my education has been quite after another fashion. I have learned my art, not in my closet ; no, nor by hearing the discourses of physicians, (though that also, I have not despised) ; but in the Hotel Dieu, where I lived for three years, seeing many diseases, and practising many operations upon the living body ; and learning also much of the anatomy upon the dead ; and this I trust I have given sufficient proofs of in the public schools.”—“ But I have yet more to boast of ; for, being called into the service of the kings of France, I have in my time served four successive kings, and I have followed them in battles, skirmishes, and assaults ; sometimes I have been in sieges, and sometimes blocked up with the besieged, curing their wounds.”—“ And, last of all, I have lived in this great and famous city of Paris many long years, where, thank God, I have been held in some repute, and ranked, at least, equal with my peers ; inasmuch, that there have been few difficult, or famous cures, in which my head and hand have not been employed.—How ! seeing these things, dare such a man as you, who have made surgery no part of your study, talk of teaching me * ?”

* It may not be amiss to insert the following quotation as a specimen of the manner and language of those times, and I am directed to this passage by a good mark, the Marginal Index ; where I find the following sharp taunt, entitled by Paræus, “ Belle Similitude,” p. 781.

“ You remind me, Mr. Gourmaline, of a little scrubby boy, who had come from Lower Brittany to Paris forsooth to learn French ;—and one day the organist of the great church of Notre Dame, found him lounging about one of the gates of the Palace, and took him to blow the organ. After three years, this little round fat-arsed fellow, (*bien fessu et materiel*), sensible that he had learned not one word of French, returned to his father ; telling him that now he could speak good French, “ and besides, Vather, says he, I can play upon the organs.” (*et lui dit qu'il parla bonne Français et davantage qu'il scavoit bien jouer des orgues*). The father, quite delighted with such a son, goes straightway to the organist of their great church, “ Do, says the father, let my son try the organ ; for I long to know whether he be such a proficient as he says he is.” The organist very obligingly went along with them, and the boy having got into the organ, presently claps himself down by the bellows, with a sort of instinctive jump. “ Why what's this, says the organist with great simplicity ?”—O nothing, says the boy, only you had best play upon the organ, for I play best upon the bellows.” “ Now I tell you, Mr. Gourmaline, that you have been all this while playing upon the bellows, while I have been playing upon the keys ; it is a vastly easy matter, for a fellow like you, to heeze upon his chair and prattle about it ; but performing surgical operations with the knife in hand, is quite another affair.” P. 781.

“ Partant, il est à croire, que n'avez jamais forty de vostre estude, que pour enseigner la theorique (si vous l'avez pû faire) les operations de chirurgie s'apprennent à l'œil et au toucher. Je diray que vous ressemblez à un jeune garçon Bas Breton, bien fessu et materiel, qui demanda congé à son pere pour venir à Paris pour prendre France. Estant arrivé, l'organiste de Notre Dame le trouva à la porte du palais, qui le

Yet Parée was touched with their reproaches ; he allowed himself to be misled so far by the doctrines peculiar to those times, as to endeavour to prove that the principles of his invention, if not the actual practice of tying the blood vessels, was to be found in the writings of the ancients ; but, after long and diligent searching among the writings of Galen, Celsus, and Avicenna, he was unable to produce any authorities which could either support his new practice, or injure his fame. It was a discovery which set him higher in surgery than Harvey is in medical science, and it was altogether his own. Had this invention been well received, it must, in the course of two long centuries, have improved surgery very greatly, and saved innumerable lives. It would have rendered many operations practicable which the older surgeons never ventured upon ; and have made those operations safe which were not so till of late years.

Parée neglected nothing which could give effect to this important discovery. He tried to demonstrate, that even the ancients would have approved of the practice. He also supported his reasoning by facts ; by his amputations, and other operations, and by his successes in the most dangerous wounds. He gave the attestations of many eminent surgeons, and especially of Gulliemeau, who then lived in the house with him as his pupil, and who, in the end, acquired a character worthy of his breeding. Nor can we observe, without surprise, how perfect Parée's operations were even in the infancy of this discovery.

Parée had three general ways of tying an artery ; by passing the needle round the artery, down on one side and up on the other, and so tying in along with it a quantity of flesh ; or by drawing the arteries out from the wound, as from the face of a stump, by the artery forceps with a spring handle, which he called *Valet a Patin* ; or by striking the needle above the place of the wound, through the flesh of the limb, down quite to the bone, so as to tie in the great artery of the limb, and along with it much of the flesh.

print pour souffler aux orgues, ou il fut trois ans. Il vid qu'il parloit aucunement François, il s'en retourne vers son pere, et luy dit, qu'il parloit bonne France, et davantage, qu'il seavoit bien jouer des orgues. Le pere le receut bien joyeux dequoy il estoit en si peu de temps si çavant ; il s'en alla vers l'organiste de leur grande eglise, et le pria de permettre à son fils de jouer des orgues, a fin de seavoir si son fils estoit bon maistre ainsi qu'il disoit ; ce que le maistre organiste accorda volontiers. Estant entré aux orgues, il se jette de plein faute aux soufflets, le maistre organiste lui dit, qu'il jouait, et que luy souffleroit ; alors ce bon maistre respond, qu'il jouait luy mesme des orgues s'il vouloit ; car quand a luy il ne pouvoit jouer que des soufflets. Je croy aussi ; mon petit maistre, que vous ne seavez autre chose que caqueter en une chaire ; mais moi je joueray sur le clavier et ferai resonner les orgues ; c'est a dire, que je ferai les operations de chi-

“ If there be a bleeding artery, says Paræus, in any wound, dress the wound with astringents ; but be careful at the same time to lay a firm compress over the wound, and settle it well with a bandage, and then lay out the wounded limb in an easy way.”

“ If this do not serve, clap your finger upon the point of the artery, and wait patiently till a clot be formed.”

“ If the artery continue to bleed, cut up the wound, (if it have been sewed), and pass a needle under the artery, enclosing along with it in the ligature much or little flesh, according to the circumstances of the case.”

“ If the artery have shrunk up among the flesh, cut up the wound and tie the artery higher.”

“ But should both ends of the artery have been still further retracted, then continue your incision, and cut open the skin freely, still pursuing the artery ; but still careful of the very artery that you are pursuing, lest you should cut it a second time.”

“ In an amputated stump, draw your arteries out with the forceps, tie them neatly with a thread ; but if once you miss the artery, or your first thread give way, do not use the forceps any more ; but pass a needle four inches long into the stump, so as to tie in the artery, along with much of the flesh.”

“ These ligatures we are careful not to withdraw too early ; nor must they ever be removed till the granulations of flesh have grown up to protect and strengthen the artery.”

“ If these operations fail, we must have recourse to caustics, vitriols, or the actual cautery, which make eschars and crusts ; and we must be careful to prevent these eschars falling off till the flesh be formed.”

“ Sometimes also the surgeon needs to cut the vessel entirely across, by which its ends, shrinking both ways among the flesh, the flux stops : but always the surest way is to tie the vessel before cutting it thus across *.”

rurgie, ce que ne sçauriez nullement faire pour n'avoir bougé de vostre estude et des escholes, comme j'ay dit.

* “ Puis par dessus sera mis une compresse, et ligature propre, et la partie sera tenuë en bonne et deüe situation, et principalement sans douleur, s'il est possible.—Et là où le sang ne pourroit estre estanché par ces remedes, alors on otera la compresse, et pressera-on du doigt sur l'orifice du vaisseau, et y sera tenu jûsques à ce qu'il soit fait un thrombus, c'est à dire, que le sang dedans, et autour l'orifice du vaisseau soit caillé, et par ainsi est engardé de fortir.—Or, si la sang ne laissoit de fluer, alors faudroit descoudre la playe (si on y avoit fait future) et prendre le vaisseau par dessus avec une aiguille vers sa racine, avec bonne por-

This is a system of instructions which is fairly extracted from Paræus's books, without mending the text, and though this system be now one hundred and fifty years old, it is such I believe as the best surgeon at this day in Europe could hardly improve. In correctness of practice, surgeons, from his time, went backwards for many ages. They were afraid to follow the bold surgery of Paræus; monstrous fancies haunted their imaginations: Some had real fears, while others were pleased to find arguments of any kind against a practice so opposite to the scholastic doctrines which they had long cherished; they were afraid, lest the ligature should give way, and they said it would cut across the artery! it would make the end of the artery mortify! it might be thrown off by the continual beating of the artery! so they stitched up the artery, cross tied, and knotted it, and took all kinds of security. They not only tied one ligature round the artery, but they at the same time transfixed it with a needle, and then twisted together the knots of both ligatures, and then, like children, afraid of what they had done, they feared lest this firm tying of the artery might occasion locked jaw, or universal convulsions; so that on their amputation table, was produced nothing smaller than tapes, and their needles, which were three or four inches long, were carried round each artery, at the distance of an inch, and sometimes through the whole thickness of the limb. It is only after much experience, and by very slow degrees, that we have learnt at last, that the drawing out an artery, with the forceps or tenaculum, and the tying it fairly with a small ligature, the method which appeared to the older surgeons to have every fault, is absolutely the most secure.

tion de chair, selon que la partie le pourra permettre, et le lier: Car par ce moyen j'ay arresté de grands flux de sang, mesme aux amputations des membres, comme diray en son lieu.—Quelquesfois faut decouvrir le cuir par dessus, puis le lier, comme si la veine ou artere jugulaire avoient esté coupées: si elle se tire tant en sa partie superieure qu'inferieure, il faut alors, pour la lier, esleuer le cuir là l'endroit du vaisseau, et le couper sans toucher audit vaisseau: puis estant decouvert, il convient passer une aiguille enfilée par dessous, puis la lier: ce que j'ay fait plusieurs fois.—Et devant que d'oster le filet duquel on aura lié les veines ou arteres, faut que la chair soit engendrée dessus, afin de boucher leurs orifices, de peur que le sang ne descoulast derechef: parquoy ne se faut trop tost avancer de tirer ledit filet, que premierement la chair ne soit regenerée.—Et là où le vaisseau en quelque partie que ce fust, ne pourroit estre lié, faudroit venir aux medicaments, eschorotiques, faisans crouste, comme poudre de vitriol calciné, poudre de mercure avec autant d'alum calciné, ou cautere potentiel, lesquels font escarre: laquelle ne faut faire tomber, jusques à ce que nature l'aye fait choir d'elle mesme, et que l'ocher le sang, le Chirurgien est contraint de couper du tout le vaisseau, pource qu'estant coupé, chaque portion se retire vers son costé, et se cache dedans la chair, estant recouvert des parties circonceintes qui sont dessus, et lors avec peu d'ayde ledit flux.

OF COMPRESSION.

WE must not wonder, that the surgeons of those ignorant ages, schooled as they were by the physicians *, and under the dominion of a false learning, rejected this improvement ; for the last struggle against it was made by the most celebrated surgeon of modern Europe, Mr. Petit.

You must observe, that neither styptics, nor cautery, nor vitriol buttons, nor agaric, nor any other means of suppressing hæmorrhagy, ever was used alone. The agaric and vitriol buttons were always reinforced by compress and bandage ; the eschars of cauteries were supported by those graduated compresses ; nor did the surgeon ever trust entirely to the ligature itself, but supported the vessels with compresses and bandage, even when the needle was used ; often he crammed a wound with astringent powders and hare's fur, supported these first dressings with a compress, and kept the tourniquet skrewed with a dangerous and painful degree of firmness round the limb. The great abilities of Mr. Petit, the period at which he lived, (when surgery began to be a free branch of science) ; the irregularity of the practice in regard to wounded arteries ; and, above all, the aversion to the use of the needle, and the fear of convulsions, gave to his speculations very particular importance. He preferred compression to all other means of suppressing hæmorrhagy, and believed that bleeding was stopped, not by the obliteration or retraction of vessels, but by the formation of clots.

Mr. Petit believed, that every bleeding artery was stopped merely by the coagulum which formed in the mouth of it : that all means of arresting hæmorrhagy were useful only in proportion as they formed solid coagula : that the coagulum varied in its shape according to the means by which it was produced ; and the security he thought more or less perfect, according to the shape of the coagulum. Astringents formed clots by coagulating the blood ! Sponges, bovista, and scraped lint, formed clots by absorbing the moisture ! compresses made firmer clots, by shutting, and sometimes doubling down the mouths of the arte-

est estanche.—Mais devant que le couper, si on le peut lier, comme avons dit cy-dessus, sera encores plus seur.

* Even so lately as the year 1738, Hoffman, in his *Medicus Politicus five regulæ prudentiæ*, says, *Medicus nimiam familiaritatem cum Chirurgo non ineat—in cura Herniarum ne castrentur viri impediat Medicus.—Examinat Instrumenta Chirurgica, visitat emplastra unguenta, &c.*

ries, allowing time for the firm coagulation of the blood! Even the tying of arteries he thought more secure, in consequence of the peculiar form of the clot formed within the artery; and when (as sometimes happens) there was a slight bleeding upon pulling away the ligature, he ascribed that to the conical form of the clot, and to the blood gliding by the side of it; when there was a more dangerous bleeding upon pulling away the ligature, he imagined it to proceed from the clot slipping forwards in the artery, and being at last entirely expelled from it. In a tied artery, says Petit, we observe the clot to be of a conical form! In an artery, which has been stopped by compression, we find the mouth of the artery quite flattened, and the clot of the shape of the reed of a hautboy; but in arteries stopped by lint, or astringents, we have a clot formed, partly by the contraction of the mouth of the artery, partly by the effect of the dressings, in which case the clot is formed half without the artery, and half within; the flattened part of the clot within the artery serving as a sort of plug, while the part that is without lies over the mouth of the artery like a cap or cover, and this part is so connected with the clot within, and at the same time so adheres to the dressings without, that the rude or early removal of the dressings pulls it away.

The Doctrines of M^{rs}. Petit & Pouteau explained



This is the whole of Petit's doctrine, which is triflingly ingenious, dangerous in practice, unworthy in all respects of so great a man; yet such hold had it got upon his mind, that he wrote upon it as if his fame had been to rest upon this discovery alone; and for the sake of this doctrine he published the most daring facts, and persevered in the most dangerous practices. The Royal Societies of England and France were the organs by which the learned of those days

were connected with the public, and formed a natural connection betwixt the two countries. The philosophers, but particularly the physicians, of both countries, were impatient to have their trifling papers introduced into these journals. Mr. Petit having set himself to dissect for clots in aneurisms, and in those who died after amputation, easily found proofs sufficient for his purpose; among the chief of which was a larger and solid clot, about three inches long, which he found in the femoral artery of a man who died on the 5th day after amputation of the thigh, which artery was presented to the Royal Academy of Sciences in great pomp. Perhaps it would be easy to show that the great Academy of the great monarch, Louis Quatorze, was easily satisfied, in presents of this nature; but why should we contradict the fact, since the proving that such clots exist, does not establish this dangerous doctrine; the artery is not closed by the clot of blood, but the clot of blood is formed in consequence of the closing of the artery. How, indeed, can we suppose any artery to be closed by a ligature without the blood stagnating behind it? or the arteries of a gangrenous limb to lie quiescent and inactive for days without the blood coagulating in them? White and Hunter have found coagula of blood in aneurisms, in the arteries of amputated stumps, and in the arteries of a gangrened limb! but we have, on the other hand, many dissections where no such coagula had formed. The coagulation of the blood then is a mere accident; and Mr. Pouteau undertook a work of supererogation, when he set himself seriously to prove that hæmorrhagy is often stopped without such clots being formed.

Yet this miserable theory, like a sickly child, became every day dearer to Mr. Petit; and he never thought he could do enough to protect and strengthen it. In the year 1732, he entered upon a long suit of experiments, in order to ascertain the power of the several absorbents and astringents, and to make a scale of them: "Astringents, and such substances as usually are employed for staunching the blood of wounds, surely must do so, says Mr. Petit, chiefly by absorbing that humidity which lies between the vessels and the flesh." Petit made all his astringent absorbents, that they might drink up the thinner parts of the blood, and so help to form for him good, stiff, solid clots. He put lumps of mutton into tea-cups, with a reasonable proportion of the following astringents; first of Common Bole, then of Terra Sigillata, which is a finer earth or bole, then of Paris plaster, then of slacked lime, then of various astringent gums, then of Gum Arabic, then of Vitriol, then of Salt, then of Sugar; and, last of all, of Cob-

webs; and observed, with most curious precision, the exact degree in which each of these foolish things contracted, or hardened the lumps of mutton; which experiments are still extant in excellent French, in the Acts of the Academy of Sciences for the year 1732; a perfect burlesque upon such experiments, and such subjects: Towards the end of this most philosophical paper, Mr. Petit inserts this wise caution, which completes the joke: "But all these astringents must of course absorb more humidity, and act in a more lively and perfect manner in the living body, whose parts are always warm, and always ready to put themselves in motion by the force of the animal spirits, which are continually flowing*." There is not even in the Annals of our Royal Society, any thing to be compared with this. There were, indeed, some experiments made in this country upon astringents, of pretty nearly the same rank with those of Mr. Petit; I mean the experiments of Mr. Young of Plymouth, published in his far-famed book the *CURRUS TRIUMPHALIS, ex TEREBINTHINO*, a eulogium on the virtues of boiling turpentine as an astringent. He observed, that turpentine, spread upon a deal board, became quickly dry: that painters used it in mixing their colours, to make them dry suddenly; and he found, upon dipping his finger first into reeking blood, and then into hot oil of turpentine, that it begat a sensible straitness," &c †.

But I should want all apology for this long account of Petit, and of his doctrine, if it were not that it is a dangerous doctrine, and had absolutely led Petit himself into great mistakes; he persuaded himself that the ligature was hardly more secure than any common means of suppressing bleeding; that it was only in so far useful, as it ensured a firm and conical clot; that if the ligature fell off before this clot was fully formed, and perfect in its office, the artery would bleed. He therefore preferred the use of a compress, to that of a ligature, even in securing the arteries of a great stump: And we find him boasting, that though this method, viz. of compression, is the oldest of all, he will give to it all the effects of novelty; "and since compression is the most natural way, and the very means which should have presented itself, first of all, to the imagina-

* "Tous ces astringents doivent absorber plus d'humidité, et agir plus efficacement, sur les parties d'un corps vivant, qui sont chaudes, et toujours prêtes à se mettre en contraction par les esprits animaux qui y coulent incessamment."

† Whence he concludes, "that it restrains an hæmorrhage by contracting the orifice, and begetting a firm coagulation of the blood; which coagulum, &c. page 46.

tion of the surgeon, I will restore it, says Petit, and set it up above all other means; as cauteries, astringents, sponges, or even the ligature." There is not one of all these, says Petit, that is sufficient of itself; we must use the compress to assist even the ligature.

We have here a most curious example of a man's genius and his good sense at variance with each other. His theory seduced him, his good sense would have kept him right; he forces himself, as it were, to say, "I will use the compress in preference to the astringents, styptics, caustics, or even the ligature itself; wherever it is possible for me to do so *:" which is plainly acknowledging, that he would use that kind of uncertain operation, to which his theory inclined him, wherever he was not forced by the immediate danger of the case, to betake himself to some surer means of restraining the blood.

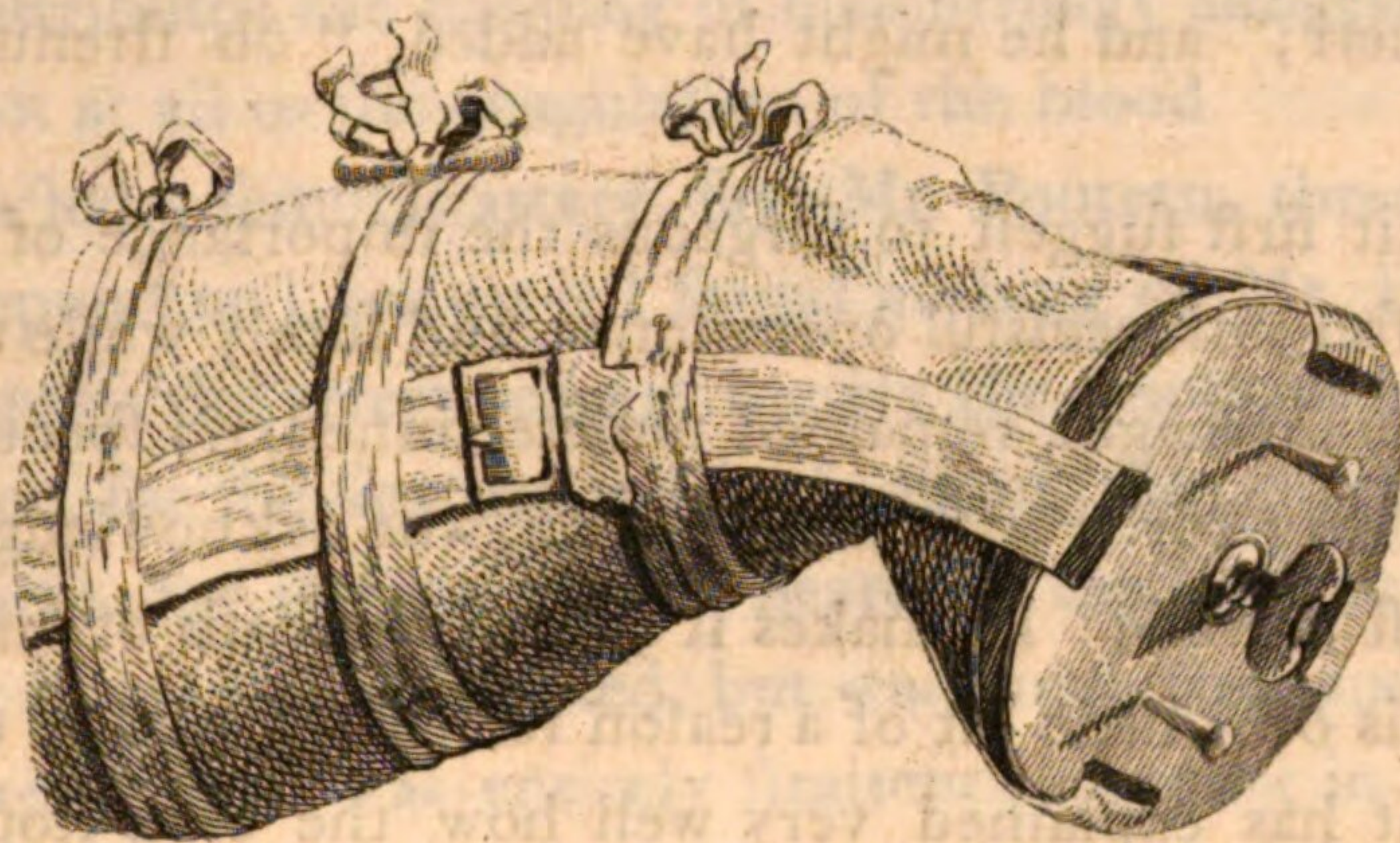
Experiments, of the philosophical and speculative kind, we can endure; but experiments on the human body are not so easily vindicated. Mr. Petit maintained, not only theoretically but practically, that compression was the surest means of suppressing hæmorrhagy. "The art, says he, of stopping hæmorrhagy by compression, consists less in the force that is used than in the steadiness with which it is applied. The slight pressure of the finger alone is sufficient, if but the stump and the finger could be kept steady; nor is any thing required to make compression perfectly successful, but to invent a machine which shall perform the office of such a finger. Such a machine did Mr. Petit invent. It was a complicated tourniquet, consisting of one circular, which compressed the artery in the groin, and of two parallel plates of iron, which were moved by a central screw, and compressed the flat face of the stump †. To vindicate this strange invention, he delivers a case of an ossified femoral artery,

* "La compression a dû être le premier moyen qui s'est présenté naturellement à l'esprit des hommes, pour arrêter l'hémorragie; c'est aussi celui qui est le plus efficace; et quoiqu'il soit le plus ancien, je me flatte de lui donner aujourd'hui tous les avantages de la nouveauté, soit par rapport à la manière de comprimer les vaisseaux, soit par rapport à l'usage exclusif que je lui donne, en rejetant celui des astringens, des styptiques, des caustiques, et de la ligature même, *autant qu'il est possible*. Je commence par quelques observations sur la manière dont la nature concourt avec l'art pour arrêter le sang."

† It was perhaps the only wrong thing Petit ever did, and he has not been spared. Mr. Gooch, and Mr. B. Bell, the *alter ipse* of Gooch, have persecuted him with such praise as they could bestow. Petit's spirit has fully expiated this one fault; nothing can be more degrading than injudicious praise; nothing can be more dangerous to a man's posthumous fame, than to have those things commended and recorded which should in mercy be forgotten.

which, after amputation of the thigh, stood out with open mouth, and was not affected even in the slightest degree by the firmest drawing of the ligature.— Strange case ! since nothing of the kind had been ever heard of before ; nor has any thing like it occurred since, though amputation is our daily work.

Petit's Tourniquet for a Stump



Beuge sc.

Thus we perceive to what extremities Petit was driven to support his doctrine, and his aversion from the needle, and his perseverance in using compression, is strongly marked by the following fact: “ A nobleman of the first rank in France, and in whose fate the whole kingdom took an interest, having been wounded in the thigh bone with a musket-ball, lingered, in a very miserable condition, for nineteen years : at the end of which time the surgeon discovered, and extracted, by incisions, some fragments of bone and some pieces of iron, (especially the ball of a scrutoire key), and along with them some rags of his breeches ; but, his strength being quite exhausted, they were forced to amputate his thigh.

This gentleman, some days after the operation, very imprudently raising himself suddenly in bed, without help, the femoral artery burst out ; and such was the aversion of Petit from using the needle a second time, or the cautery, or vitriol button, or any thing but his favourite compression, that he appointed four young surgeons to watch with him, two and two, night and day, pressing upon the face of the stump.

Compression was much practised in those days ; the authority of Petit revived it just at the time that surgeons began to be familiar with the needle, and to lose

their apprehensions of spasms and convulsions. To have young surgeons and assistants sitting upon the side of the bed for days, keeping in the blood, was no unusual thing. All surgeons practised this method, but none of the old surgeons perhaps ever fell upon so ingenious and good humoured a device as Ruinhuisen. He had a patient who, from a venereal ulcer on the back of the glans, had a very dangerous bleeding, which no styptics could subdue. He set down two tailors to compress it with their thumbs: "*Duo alternatim sartores tanquam vitæ sedentariæ adfueti*;" and he might have added, "*ob strenuos indomabiles digitos* *.

Thus did Mr. Petit first suggest to surgeons the importance of examining the state of the artery after unsuccessful operations; and surely while the line of conduct, in regard to hæmorrhages, remained undetermined, no speculation could be more interesting. After Mr. Petit came Morand, who acknowledged the doctrine of Petit in its utmost latitude: he makes it indeed the basis of his own: he does no more than add his own little bit of a reason for the formation of clots. "No doubt, says he, Petit has explained very well how the clots stop hæmorrhagy; but these clots surely will be the firmer, if they are helped somewhat by contraction of the artery." His idea of the state of the artery, which assisted in forming, or in supporting the clot, was miserably confused; it was neither that contraction of diameter in the artery which Kirkland, White, and other English surgeons, have supposed; nor that retraction of the artery among the surrounding flesh which has been so much insisted upon by Pouteau and other respectable writers, but an equivocal generation betwixt those two ideas floated in Mr. Morand's brain. Through the whole of his laborious paper he expresses his confused idea by the word "*crisping up of the artery*," *par la crispation du tuyau*; and he

* This was no uncommon thing, and was a strong proof how imperfect all these methods of suppressing hæmorrhagy were. Mr. Turner says, "And here I can assure you, that in a desperate hæmorrhage of the like kind, I have had this post myself for six hours successively, retaining an emplastic, shifting my fingers as they were cramped, and taking my repast at the patient's bed-side, not suffering a drop of blood to be lost for that time, although a cough attending gave us fearful apprehensions, as well as an unruly patient we had to increase them. Upon removing my finger, the dressings being dry, and sticking close, I gave a charge to two others, hired to sit up all night, and take their turns, how to perform the same task; but whether through remissness or inadvertency, upon a violent fit of coughing, beyond the reach of a full dose of an opiate I had given him, before I took my leave, to alleviate the same; notwithstanding their endeavours, who, in the surprise I suppose, mistook the place of compression, the artery burst out afresh, and the patient living out of town, was exhausted before I or any other help could come to assist him."

can tell no more of the process than that this cabbaging of the artery assists the clot. In short, he subscribed to the doctrine of Mr. Petit, but could not refrain from adding something of his own; and I believe I have done justice to the idea of Mr. Morand, in supposing that he imagined a curling back of the mouth of the artery, a sort of intus-susceptio, such a straightening of the tube, as was favourable to the formation of a clot.

Next came Mr. Pouteau, a bolder speculator, who at once rejected the doctrine of Petit, and attributed the stopping of hæmorrhagy altogether to the condition of the artery, not at all to the coagulation of the blood.

"I have dissected a femoral artery, says Mr. Pouteau, three weeks after it had been tied in amputation; but in it I found nothing of Mr. Petit's clot; nothing to close or compress the artery, except merely the thickening of the surrounding cellular substance, for the ligature was loose about the artery! the canal of the artery was conical, for it grew narrow nearer to the ligature! Immediately under the ligature it was not obliterated, but was much straitened: It was only below the ligature that it was entirely straitened, ending in a blind sac." This straitening of the arterial tube was accompanied, or rather, according to Mr. Pouteau, was caused by a thickening of the surrounding flesh; for the flesh, he observed, which surrounded the straitened part of the artery was a good deal gorged and swelled, that which lay immediately under the ligature was in a state of gangrene; the flesh again which adhered about the mouth of the artery, where it ended in the blind sac, was of a cartilaginous hardness, and much swelled. It was Mr. Pouteau's opinion, that the swelling of the surrounding cellular substance compressed the artery, and stopped the blood.

This, then, being the doctrine of Mr. Pouteau, his practice follows his doctrine reasonably well; for, says Mr. Pouteau, "let it be once proved that it is the swelling merely of the parts surrounding the artery that prevents the blood flowing out, and it follows of course, that the greater the bundle of flesh that is accumulated round the artery, the more of the parts you include in your ligature, the greater the swelling must be, and the resistance to the eruption of the blood must be proportionably great*.

The doctrine of Mr. Pouteau seemed to be, at least, harmless: It seemed in-

* "Mais s'il est une fois avéré que le gonflement des parties au dessous de la ligature, fait le principal obstacle à l'irruption du sang arterial, il sera naturel de conclure, que plus ce gonflement sera considérable, et plus il opposera de résistance à l'impétuosité du sang arterial.

deed to inculcate the safest practice of all, viz. that of tying arteries with the needle firmly. But here we see the villany of false doctrines, which lead us unawares into such practices, as, in our cooler moments, we cannot but remember with regret. This doctrine requires that the operator should tie in all the surrounding parts; and Mr. Pouteau made no scruple, under this ample title of all the parts, to comprehend the great nerves also. He regarded the tying in of the nerve as a security to the artery, or rather I fear he considered this cruelty as a security to his doctrine. He proceeds to represent the tying in of the great Radial Nerve in aneurism of the arm as nearly harmless, and the tying in the nerves, along with the arteries of an amputated limb, as quite so. Thus an opinion, which the world imagines to be the pure result of experience, and receives as an independent and absolute fact, is a mere appendage to a trivial doctrine! and this affirmation that it is safe to tie in nerves, although it comes from a practical surgeon, deserves no more notice than if it had come from a Spallanzani, or Fontana: yet has it been implicitly received, the doctrine has made already an alarming progress; at first surgeons were apprehensive of nothing so much as spasms and convulsions, from the tying or injuring of nerves; but now, in the other extremity, they are come to sport with their patients feelings; and Kirkland, a surgeon justly celebrated for his good sense and conscientious attention to the practice and improvement of his profession, says, in one part, "May not the pain, upon tying a nerve, as it is smart and of short duration only, somewhat in the manner of volatiles applied to the nose, rather enliven the spirits than bring on convulsions*." This is enough to cure any sensible man of any inclination he may have indulged, for those who blend theory and facts in this strange fashion, who compare the smart pain, or rather as I would term it, the shock and terrible violence of tying a nerve with so slight a matter, as the snuffing hartshorn up the nose. Let any man who will talk to me on this point, first demonstrate that the tying in of nerves will do good, before I close with him upon the secondary question, whether it may not do harm.

Allow me here to observe two things: I, in the first place, disapprove of tying in the nerve! it is not the convulsions I fear, nor the pain of tying in the nerves, considering the nerves but as dead parts, these consequences will never fail to ensue; the nerves are peculiarly firm and unyielding in their nature, they undergo their changes very slowly, they do not fade under the ligature as the artery does,

* Kirkland, p. 22.

Drawing of Nerves imprudently tied in along with the Femoral
Artery in Amputation — p. 177



- a The Femoral Artery
- b The Profunda
- cc The Inguinal Glands
- d Anterior Crural Nerve
- f The Clot of Blood above the Ligature

- cc The two chief Branches
of the Anterior Crural Nerve
tied in along with the Femoral
Artery & the Profunda

nor yield when we would pull the ligature away; the ligature keeps its hold upon the nerve, remains firm, and, acting as a foreign body, prevents the adhesion of the surfaces of the stump, or of any smaller wound: the irritation often produces Erysipilatous inflammations, and in the end we are obliged to pull such ligature away, or cut it off from the nerve, not without violence and danger. I have seen ill consequences arise from the tying in of nerves in aneurism, both of the thigh and of the arm, which at present I would not choose to explain: Indeed in this very dissection of the femoral artery by Mr. Pouteau, we find that three weeks after amputation the ligature stuck firm in the stump, which could not have happened otherwise than from his imprudent practice of tying in, along with the great artery, much of the surrounding flesh, and the anterior crural nerve; and thus his doctrine also leads to incorrect and dangerous practice.

Secondly, I would observe that Mr. Pouteau has contrived to support his doctrine, by explaining only half the truth: He has not given a fair representation of the condition of a tied artery: He represents to us a great arterial trunk tied coarsely with the needle, with much flesh and cellular substance tied in along with the artery, and so takes the opportunity of insinuating his doctrine, by saying, "There was in this dissection much cellular substance thickened above the ligature, and there was a like thickening of the cellular substance below; the mouth of the artery was closed, but that part of the canal, which lay immediately under the ligature, was not obliterated." In the present day we use the tenaculum; the artery is drawn far out from the surrounding flesh; we tie the artery alone, and the nerve is not included; there is no cellular substance round the artery to swell and close the mouth of it.

Amidst this confusion of opinions there was engendered here in England a new doctrine of the CONTRACTION OF ARTERIES; and you will observe, that there is a distinct connection among all these theories, and a very natural progression of ideas, from the cramping of the artery, which Mr. Morand supposed to that contraction of the artery which has been observed by the English surgeons; a doctrine which they have been at infinite pains to establish, but which carries nothing with it imposing, except the names of White, Kirkland, and Dr. Aitken, who were the chief supporters of it. If these gentlemen had affirmed that the retraction of arteries among the cellular substance was the accident which prevented great loss of blood, the theory might have led to very interesting conclusions; but their theory was quite different. They imagined, that when the

artery was cut, its mouth gradually contracted, its diameter being abridged, and the stream of blood diminishing every moment, till it entirely stopped by the mere contraction of the artery. Their doctrine went still farther; they ascribed even the obliteration of the higher parts of the artery, (i. e. from its mouth up to the next branch), to this contraction of its coats.—“ I am now convinced, says Mr. White, in opposition to the doctrine of Pouteau, which once seemed more probable, that according to the supposition of Mr. Gooch, since confirmed by my ingenious friend Mr. Kirkland, the arteries, by their NATURAL CONTRACTION, coalesce as far as their first ramifications * :” And Mr. Kirkland says, “ that nature suppresses the hæmorrhages from divided arteries, by the natural contraction of their muscular fibres † :” And Mr. Aitken of Warrington adds, “ that the obliteration of the sac, in the extremity of the artery, is caused by its NATURAL CONTRACTION ‡.” We have but too much reason to be jealous of any doctrine which might beget an indifference to the securing of arteries by ligature; and should we revive this doctrine of the contraction of arteries, then we should be inclined to wait for their retraction, and should conclude with Petit, that a compress, or the slightest astringent, were better and safer than the needle. Those speculators did indeed draw this bold conclusion from their theory. “ In all smaller arteries, it is, say they, sufficient just to clap the point of a finger upon the artery, and wait till it has shrunk.”

This doctrine, then, is as dangerous as that of Mr. Petit! when a hæmorrhagy is interrupted only by clots, or when a hæmorrhagy has relented from the mere contraction of the artery, the patient is never free from danger, nor the surgeon from alarm. Doctrines like these will never serve as a basis for sensible rules of practice; and I think it therefore important, in this place, to explain to you my own opinion of this matter; for whether an artery be tied, or have stopped spontaneously, it is in a condition very different from what has

* Page 171.

† Page 10.

‡ Vide Mr. Aitken's Pamphlet, page 193. These gentlemen have been at great pains to establish their doctrine of the contraction of an artery on principles and facts. The only facts, are the docking of horse tails, and the cutting off their legs. These are to be found in Mr. Kirkland's Treatise; and the only principle, that is to say, the only general fact, which I have ever yet been able to discover, is, that an artery closes, not only immediately under the ligature, but for a considerable way above, that is, up to the nearest inosculating branch. The closing under the ligature is plainly the work of the ligature; the obliteration of the canal, higher than the ligature, is supposed to arise from this CONTRACTION of the artery.

been hitherto described; and many of the precautions I shall afterwards recommend to you must have a very direct relation to the condition of the artery, which neither is closed by the contraction of its circular fibres, nor obliterated by the pressure of the cellular substance.

Let us then consider the following points of doctrine, with the practical inferences that are to be drawn from them: First, The natural causes by which a hæmorrhagy is stopped; and, secondly, The condition of an artery when tied with a ligature.

OF THE NATURAL CAUSES BY WHICH A HÆMORRHAGY IS STOPPED.

WHEN an artery has been tied securely, we are, from that moment, free from all uneasiness; but when it stops merely by pressure, by astringents, by the formation of clots, by the contraction of the artery itself, whenever hæmorrhagy stops from any natural cause! it is apt to return; and we inquire anxiously into those natural causes for this reason; that hæmorrhagy is at the first easily stopped; it ceases even from the faintness of the patient, if not by the interposition of the surgeon; but it is this accident of secondary hæmorrhagy that chiefly alarms us.

When hæmorrhagy stops of its own accord, it is neither from the retraction of an artery, nor the constriction of its fibres, nor the formation of clots, but by the cellular substance which surrounds the artery being injected with blood; and to be assured of this, we have but to observe, what happens in arteries of various sizes. First, Let us suppose the wounded artery to be so small as just to spurt out its blood; the stream of blood gradually lessens, because the artery is emptied, and the resistance to the arterial action taken away; the stimulus being gradually lessened, the artery every moment acts less powerfully; and the blood being no longer solicited or urged on by the arterial contractions, forsakes the open artery, and moves along the neighbouring branches. The surgeon claps the point of his finger upon the mouth of the artery, and holds it there; the outward bleeding is prevented; the blood is extravasated into the cellular substance round the mouth of the artery; the cellular substance is slightly injected with blood;

that blood coagulates; and that slight barrier is sufficient to restrain the bleeding of a small artery, till the parts inflame, and the artery is entirely stopped.

Secondly, Supposing the artery still larger and more powerful, and that it drives its blood very furiously among the cellular substance, it is not this slight injection of the cellular substance that will restrain the bleeding! whenever the finger is removed, the blood bursts through this slight impediment! The injected cellular substance will not support the artery, unless the cellular substance itself also be supported. Suppose then that the surgeon first claps his thumb firmly upon the artery, and then thrusts down a piece of sponge close to the wounded artery, applies over that a compress, and bandages over all to support the sponge and compress in their place; the artery still bleeds (though in a restrained way) both into the cellular substance beneath the sponge, and into the sponge itself, till at last the blood coagulating in the sponge, and in the cellular substance, they become as one mass, and often the sponge keeps its place till the parts inflame and suppurate, when, of course, the wounded artery heals along with the other parts.

Thirdly, But often it happens that the blood, which was at first firmly coagulated, begins to lose its consistence; or that by some unwary motion, or by a febrile excitement, the artery acts violently; more of the cellular substance is filled with blood, and the first firm coagulum and the sponge being removed from the mouth of the artery, the softer cellular substance behind them is filled with fluid blood, and the artery, forcing that slighter obstacle, bursts out again.

Fourthly, Supposing the surgeon to be bold, but not dexterous, and that, in place of using the sponge, he makes a dive with the needle at that part which he observes the bleeding to come from! He never sees the proper mouth of the artery; the injected cellular substance conceals it from him; he thinks he has tied the artery, when, in truth, he has tied only the cellular substance over the mouth of it; the bleeding is suppressed for a moment; the cellular substance, betwixt the mouth of the artery and the ligature, is filled with blood; that blood coagulates; the ligature serves but as a compress, till some accident fills more of the cellular substance; the mouth of the artery is farther removed from the ligature; the cellular substance dilates, in consequence of the artery injecting it with fluid blood, till at last it gives way, and the hæmorrhagy bursts out anew. Thus we perceive, that retraction of the artery has no effect in suppressing hæmorrhagy, but as it fills the cellular substance; and that this injection of the cellular substance is but a slight obstacle, fit to support only the

very smallest arteries. The natural powers which restrain hæmorrhagy do but suppress it for a time, and expose the patient to secondary hæmorrhages; and sponges and styptics are hardly to be trusted any more than the mere retraction of the artery. The hæmorrhagy is seldom restrained by such means, long enough to allow of the inflammation of the parts, or the obliteration of the wounded artery.

The condition of the wrist, or any other naked part, and especially the sudden swelling, and the frequent eruptions of blood, after a wound in the artery, are not to be explained by any doctrine than this; and I am well contented to take a wound of the Radial Artery as a proof and example of this theory; for the accident is peculiarly frequent. The radial artery is one of that order and size which cannot be restrained but by the ligature. The superficial situation of this artery, the nakedness of the bone on which it lies, the great swelling of those naked and tendinous parts a few hours after the artery is wounded, the difficulty of finding the artery, and the cruelty of the operations which have been performed, make the case important both as a common piece of surgery, and as a general example of this kind of wound.

The Radial Artery, at the place where we feel the pulse, lies quite superficial. We even see the beating of the artery through the skin, and when we dissect the wrist, or look to a preparation, we see nothing but the artery betwixt the skin and the bone; yet when this part is wounded, we seek in vain for this superficial artery; we search for it by cutting through a most unexpected thickness of parts; this artery, which was felt so readily with the finger in its natural condition, we cannot now feel beating, even though the skin be open and the wound deep. We observe the best surgeons at a loss to find the artery; we find them thrusting down sponges, leaving tourniquets half screwed about the arm for many weeks; making unsuccessful incisions, diving in vain with the needle, and at last striking the needle through the whole thickness of the arm, so as to intercept the artery with a coarse ligature at the distance of three inches above the wound*. These difficulties never can be explained by attending only to the anatomy of the natural parts; here the diseased and the sound state of the parts must be described together, and anatomy and surgery must go closely hand in hand.

* Mr. O'Halleran.

The artery of the wrist lies not immediately under the skin, but under a thick fascia, which, in its natural state, attracts but little notice. The general fascia of the fore arm, strengthened remarkably at the two condyles of the shoulder bone, and farther reinforced by the tendinous expansion of the biceps muscle; descends very strong along the fore arm, enclosing all the flesh; the fascia is very thick at the wrist, where, though it is a firm and continuous web of tendon, its glistening fibres are distinguished running across the arm, and binding down the flexor tendons. Under this fascia the radial artery lies: this fascia is connected with the tendons below by a loose and gliding cellular substance; and it is moreover to be remembered, that all through the body each artery has its own peculiar sheath of cellular substance! even the smallest muscular arteries have such a sheath. This fascia, which is itself but a firmer cellular substance, is surrounded with a looser tissue of cellular membrane, both on that surface which lies upon the muscles, and on that which is connected with the skin.

No sooner is the radial artery wounded than the awkward attempts of the assistants prevent the blood bursting out freely; the cellular substance of the skin is injected with blood; and the skin, long before inflammation could come on, is inflated, as it were, to a great thickness. The artery shrinks under its fascia; the cellular substance of the fascia is injected with blood; it rises over the mouth of the wounded artery; it is injected not like the looser cellular substance of the skin! This firmer cellular substance of the fascia is so crammed with blood, and that blood is so firmly coagulated, that the parts are as it were baked together, and the hæmorrhagy is rather an oozing of blood from a substance resembling the Corpus Cavernosum Penis. The whole bottom of the wound is a fine fleshy placenta like mass; and, after dissecting with the knife through a great thickness of parts, the artery is not to be found; or only by those who are very perfectly acquainted both with these changes and with the natural place of the vessel. This is the confused fleshy like mass into which the surgeon strikes his needle. Here the blood is seen oozing, as through a placenta, at many places, but not one of those bleeding points corresponds with the mouth of the artery; so that when the surgeon strikes his needle at these bleeding points, he must fail. The oftener the blood bursts out and is suppressed, the more does the wrist thicken; the farther is the artery removed from the surgeon, and the more confused the parts become. It is by this extravasation into the cellular substance that the ar-

tery always disappears, and the bleeding ceases, before the surgeon is ready to take it up with the needle: The patient loses blood from day to day, he becomes pale, sickly, and exhausted, till at last the blood hardly retains so much colour as to tinge the sheets *.

But another phenomenon often presents itself, a natural consequence of this state of the parts. A person is brought to us a week after the radial artery is wounded; it has burst out again and again; perhaps the hæmorrhagy has been suppressed by sponges, by compression, or by a rude stroke of the needle; but, upon undoing the dressings, we are surprised with the appearance of a distinct aneurism in the bottom of an open wound; we see a small distinct pulsating tumor, regularly circumscribed, throbbing strongly, with thin and almost transparent coats. We are at first at a loss to imagine how such tumors are formed or supported. But though the wound be open, the artery is not so; the cellular substance is [partly injected with blood; the first effusion of blood is driven into the cellular substance, mixed with it, and [firmly coagulated; the second effusion has filled more of the cellular substance with recent and fluid blood, and raised it in the form of an aneurism; and this aneurism has for its transparent coat the general fascia of the wrist; but yet it is so fairly circumscribed that one would hardly doubt of its being a dilatation of the artery itself.

If I do not mistake the importance of this accident, it is a sort of duty to explain it to you still further; for though the operation of tying the radial, or ulnar artery, does not range in the catalogue of important operations, along with trepan and amputation, yet, if I be not deceived, it is more difficult than either, and certainly more frequently required.

“ A shoemaker having been at an annual dinner with some young men of his own trade, had got merry, but was not intoxicated; and some of his companions walking home with him, he swore a hearty oath that they should not pass his door without tasting a glass. Accordingly they went in along with him, and as he was reaching up to a cupboard for a bottle of spirits, an unlucky foot encountered his, and tripped him. He fell forward, and a nail which stuck out from the wall run into the palm of his hand, and wounded the Palmar Artery.

* Many cases may be found in White, O'Halleran, Aitken, &c. where a person wounded in the radial artery has bled for three weeks or a month, till the blood was little better than a reddish serum. I have taken up the radial artery after a person has been suffered to loose blood ten or twelve times during the course of a fortnight.

Instantly there was a dreadful bleeding. He fell down at last in a faint ; and so unskilfully was this poor fellow managed, that, in the course of a fortnight, he had been allowed to bleed no less than eight times. The blood burst out afresh on the slightest motion, and at intervals of no more than two days, till he was reduced to extreme weakness. He had lost immense quantities of blood. It was only by his shape that I could perceive that he had been originally a fine athletic and healthy young man."

" I found him, indeed, in rude hands. The surgeon who had attended him, and who was to perform the operation, knew nothing of the palmar arch, where it began, or to which of the two arteries it belonged, nor whether it lay above or under the ligament of the palm ; and so much was he alarmed, and so ignorant of any but the rudest means of stemming the torrent of blood, that he had a coarse bandage twisted round the hand as firm as a tourniquet ! The tourniquet itself was still round the arm hard screwed ; and the hand, by long continued pressure, was now black, not merely from extravasated blood, but from actual gangrene ; vesications appeared on it betwixt every turn of the roller. The palm of the hand was greatly heaved up and swelled, with a puffy kind of swelling. In seeking for the artery the thick skin of the palm was first cut through ; it was very thick, and exceedingly crammed with blood. The cellular substance, belonging to the palmar aponeurosis was crammed also with blood, was fully two inches thick, quite black ; it was all one uniform mass, which cut like the *Corpus Spongiosum Penis*, and no one part was to be distinguished from another.

The artery, with its usual perverseness, (though it had almost bled the man to death), would not give one drop of blood during the operation. The surgeon unscrewed the tourniquet, doused the parts with warm water ; made the patient swing his hand most painfully ; made several rude incisions, but still could get no jet of blood from the artery, nor any more than a general oozing from this spongy mass. Without fear of the palmar nerves, he made many relentless and unsuccessful dips with the needle ; at last he was most unwillingly forced to make an incision upwards along the artery : he cut the skin by the side of the flexor ulnaris muscle, and looked in vain for the artery : was surprised that he could not see an artery which he felt plainly with his finger, not knowing that the artery was still covered with its fascia ;—but having at last slit up the fascia, the artery was forced out by the tension of the fascia ; and from its

fulness, it assumed a contorted form, and was especially turgid at each pulsation. Three inches of the ulnar artery now lay exposed; it was seen running over the Pisiform bone into this spongy mass in the palm; the artery beat strongly, and was seen serpentine, and working with a sort of spiral motion, and a distinct pulsation; but there was no corresponding jet of blood, nothing but a general oozing in the palm."

"The conclusion of the case is as extraordinary as all the rest of it; the surgeon laid a ligature under this part of the artery, but would not draw it; he made another desperate dip with the needle: The lad was put to bed, and the bleeding broke out so furiously in the night-time, that had there not been a pupil watching to tie this occasional ligature, he surely must have lost his life."

This case explains to us what confusion the continual driving of the blood makes; how deep the artery lies in parts which seem to have little cellular substance, and how vain it is to look for the artery in the midst of such a mass; the artery will not bleed till all is quiet again; and even when it does bleed, it is not with a fair jet, nor with open mouth. To suppress such bleedings with a styptic, or a compress, seems to be a lenient, but is, truly, a cruel practice, and not without danger. The patient's constitution, if not his life, is often endangered before the surgeon gets courage to make the incision; and at every return of hæmorrhagy the cellular substance is more and more injected; the artery buried deeper; the incision must of course be more extensive, and the operation more difficult.

The aneurism which I have described, as formed under the fascia, and protruding from the bottom of the wound, I choose rather to exemplify from the writings of another person, than from my own case-book. Mr. Ford, of the Westminster Hospital, "was called to a butcher who had, about a fortnight before, wounded his wrist, by pushing his hand through a pane of glass. The wound was just below the Carpal ligament, over the pisiform bone. It had bled several times since the accident, and the hæmorrhagy had, with difficulty, been restrained by bandages and common dressings. *There was a pulsating tumor covered with a thin membrane, where the wound had been received*; the pulsation was with difficulty checked by a strong compression on the ulnar artery, but returned again on removing the compression.

I dilated the wound instantly, says Mr. Ford, towards the palm of the hand, and made an attempt to include the vessel within a ligature, by means of the common crooked needle. This proving ineffectual, I represented to the patient the necessity

of a farther dilatation of the wound, in order to restrain the hæmorrhage, without injury to the ligaments and tendons of the wrist ; but, notwithstanding the most urgent entreaties, he could not be prevailed on to submit to any farther operation till the ensuing day : he was therefore left with a bandage on the wound, and the tourniquet applied on the upper arm, with directions to tighten it if the hæmorrhage should return."

" I saw him again on the next day, in company with Mr. Lynn, surgeon of the Westminster Hospital, and finding that the bleeding had recurred, it was determined to prosecute the incision farther, and to secure the artery higher up in the arm."

" I began the incision where the wound had been received, carrying it superficially over the carpal ligament, in the direction of the ulnar artery, for six inches upwards in the arm."

" The operation was done with the utmost caution, to avoid wounding the tendons and muscles, which were carefully held aside with our fingers as they were exposed by dissection. This proceeding was of course tedious, in order to ensure safety. The pulsation of the vessel could not be felt ; neither could the hæmorrhagy be provoked by friction, by putting the arm in warm water, or by flannels applied hot to the part. At length, however, the artery was discovered, and a ligature carried round it, without including any other part, about an inch and a half above the wrist. Some time was then employed in endeavouring to promote a hæmorrhage from the lower branch of the artery ; but this not taking place, the wound was carefully cleaned, united with strips of sticking plaster, and rolled up with a flannel roller."

" The patient was bled, had an opiate administered, and in every respect was treated in a most antiphlogistic manner. No circumstance occurred to render it necessary to open the wound for six days ; no swelling, tension, inflammation, or fever came on. Now, it may be remarked, that the circular ligament of the wrist, together with the tendons and muscles contiguous to the ulna, had been laid bare, and exposed to the air for more than three quarters of an hour, during our search for the artery. The ligature came away on the eighth day, and the wound healed rapidly by the first intention, so that the patient was perfectly well on the twenty-eight of the same month."

I know Mr. Ford, and am sure he will pardon any observation that is meant for the improvement of others. I believe it is needless, in any such case, to cut

downwards into the palm of the hand, which is usually so injected with blood, that the most dexterous anatomist, dissecting deliberately on the dead body, would not find it easy to show the open mouth of an artery; and it were superfluous to repeat to you how improper it is to dive with a great needle into the palm of the hand; nor is this necessary! for the palmar fascia and skin are so swelled, as to prevent the return of the blood from the lower mouth of the artery. I never saw it necessary to tie the lower end of the artery, and I think it important to mention this as an exception to the rule commonly laid down of tying both ends of it, it is only the direct impetus of the blood from the upper part of the artery that bursts through this injected and spongy mass; it is only the upper end of the artery that we need to tie. Irregular and unsuccessful operations are performed only from not having a very decided intention of dissecting for the artery; but it comes always to this in the end; and the surgeon should resolve, the moment he is called to such a case, to apply the tourniquet to cut backwards along the artery; to dissect it clean; to tie it fairly; to disregard the bleeding from the lower end of the artery; to put a small piece of sponge into the place where the blood wells out from this confused mass, except in those very rare cases where he sees a direct jet of blood from the lower end of the artery, and then he may use the needle; but that rarely happens, except in very recent cases, and before the palm is much injected with blood.

* Surgeons from the very earliest times have been fully sensible of the danger of this wound in the wrist; inasmuch, that finding often their styptics, vitriol buttons, pellets of chewed paper, and hard compresses, with coins in them, ineffectual! they invented a particular machine for the wound of the artery of

* The justly celebrated Mr. White, relates the consequences of bleeding from the Radial Artery, in the following terms: "The arteries of the wrist having been cut, had been twice taken up by Mr. —, a surgeon well accustomed to the operation; and bovista and many other things had been tried. After each of these methods, the hæmorrhagy stopped for a few hours, and then frequently burst out again; especially upon the accession of a hot fit, to which he was now very liable. On the seventh day I was called, in consultation with Mr. Allan, to take off the arm: we found his hand and arm swelled to three times its natural size, from the frequent use of the tourniquet, which had been under a necessity of being moved to different parts of the arm, on account of the excoriations it had occasioned. For the last twenty-four hours it had been applied almost without intermission, from a dread of his bleeding to death, as he had lost a prodigious quantity of blood. After the dressings and clotted blood were removed, we could distinctly see the mouth of the vessel, throwing, per saltus, what I can scarcely call blood, as its colour could hardly be distinguished upon linen."—WHITE'S CASES.

the wrist, and a more formidable machine can hardly be imagined. It is formed of two great hoops of iron, connected by three flat iron rods, with strong hinges, and studded with iron nails to give it strength; it resembles our machines for broken legs, and most of all Gooch's machine for the fractured thigh bone. One circle goes round the elbow, another surrounds the wrist, and within this circle is a large padded compress, moved by a strong screw, which compresses the artery. The very form of this machine shows the extent of their fears; much more the words in which Scultetus explains it: "*Comprimitur arteria carpi consilio aut fortuito aperta, ne vitam cum sanguine profundat **:" And he adds, "that it is peculiarly serviceable in such punctures of the arteries of the carpus, as sometimes happen in duels with the small sword." The means of suppressing hæmorrhagy were imperfect among the older surgeons; and it was not without reason they feared these wounds of the carpus: We have, in the following case, a proof at once of the difficulty with which they restrained such hæmorrhages, and of the ill consequences of styptics and compression.

"One John Moser, a shoemaker, having a dispute with his apprentice boy, the wicked imp, while he was struggling with him, cut him across the wrist with a paring knife. The vein and artery being wounded, he bled profusely, with other distressing accidents. A regular surgeon being called immediately, bound up the wound according to art; but next day the blood burst out so profusely, that he was agitated with universal convulsions. On the seventh day it burst out again; he said that all night long he had dreamed of struggling with the boy; and in the morning, wandering up and down lamenting the expences of the affair; he wrought himself up into a fever, so that the blood burst out again with all its violence, and could by no means be restrained, till Scultetus clapping his finger upon the mouth of the artery, and hooking out a great quantity of coagulated blood from the wound, laid a piece of burnt sponge upon the artery, dipt in astringents mixed up with whites of eggs; bound up the wound with firm bandages, and put the great spring bandage, which I have just described, over all. In this case we may observe what quantities of blood the patient loses in these wounds; and by the

* *Consilio aperta* must be explained.—"At Pavia, says Scultetus, where anatomy and surgery have flourished for many ages, there appeared in my own day a most dexterous Arteriotome, who, at the instance of the Physicians, made very free with the Radial Artery, and, by opening it at the wrist, cured the most severe diseases of the head; and he used this compressing machine, so that not one drop of blood issued; nor did any bad consequence of such compression ever ensue."

reports of Scultetus, we are made sensible of the great sufferings this particular patient must have endured ; for, on the ninth day, the arm was greatly inflamed ; on the tenth the patient was somewhat relieved, and the yellow pus began to soak through the bandages : On the eleventh he was tolerably well ; on the twelfth the wound was dressed. The wound was very large, both from the quantity of coagulated blood that had been hooked out, as from the cavity of an aneurism ; and by the dilatation of the sponge, and the tendons of the wrist were exposed, and not only inflamed, but even tending to gangrene*.”

We find Scultetus screwing his compressing machine at every dressing, getting away the sponge very slowly, and piece-meal, the pain considerable, the matter in great profusion, the sufferings of the patients in all respects very great ; and I have no doubt, that, by such long continued suppuration, the tendons would be fixed in their places, and the hand would continue lame. But not even the coarseness of this machine, nor the manner in which they used it, nor their irregular practice of using sometimes compression, sometimes vitriols, sometimes the hot iron itself, in wounds of the wrist, can explain to us the extent of their difficulties and fears. Mr. O'Halleran's operation, though not new, (for it was performed by Parée, Guillemeau, and even by the Arabians), is more desperate than all these :

* Septimo die noctem inquietam habuit, dixitque se tota nocte per somnum cum puero, qui ipsum fauciat, pugnasse : et quod majus est : conquestus est de sumptibus, et propter illos tam melancholicus fuit, ut huc et illuc in hypocausto curreret, a quo motu sanguis ebulliens ex arteria læsa, in omnem dimensionem exiliit, ut nullo modo sisti queat. Itaque digitis compressa arteria, in media radii parte, extraxi magnam sanguinis concreti copiam ex vulnere. Tandem arteriæ fauciatae spongiolam combustam, et pulvere lapid. chrysol. præp. atque adstring. Gal. aspersam, et albumine ovi agitato oblitam imposui, conveniente fascia vulnus obligavi, et instrumentum ex bractea confectum Tab. XLIII. adhibui, quod obferari, et cochlea arteriam comprimere citra incommodi metum possit.

Octavo et 9. die quia manus usque ad mediam cubiti et radii partem inflammata erat, vesperi admisit Enema. Decimo die melius habuit, et pus flavum per fascias sudavit. Die 11. per totam noctem benè dormivit. Duodecimo die religato vulnere effluxit pus album, et vulnus latius apparuit, ob sanguinis concreti extractionem (ut in aneurismate fieri solet.) et impositam spongiam. Tendines quoque perforantes in conspectum venerunt inflammati, et summo cum dolore ad putredinem tendentes. Vulnere igitur, citra spongiolæ extractionem, detergo, arteriæ medicamenta prædicta imposui, vulnusque fasciis obligatum iterum instrumenti clavo obturavi.

Die 13. et 14. æger melius habuit, inflammatio namque et dolor manus læsæ aliquantulum remisit. Die 15. pus album de vulnere exivit, manus dolor remissior visus, et tumor ejusdem minor factus fuit, tendinesque calorem naturalem acquisiverunt. Die 16, Dimidiam spongiolæ, quæ arteriæ incisæ orificio adhæsit, partem vossella extraxi, alteram vero reliqui ad foramen arteriæ, &c.

"He takes, to use his own words, the largest convex needle, armed with six or eight threads, made flat and smooth with wax, pierces the skin about an inch above the wound, and near the same distance from the beat of the artery at one side;—he passes the needle first under the artery, and out at about half an inch distance on the other side of it. The threads being thus passed, and comprehending the artery, and the surrounding fat and muscular flesh, let a small roller of fine linen, not made up hard, be placed over the artery, and on this let the ligature be made," &c. And he ventures even to give examples of cases so desperate as to require this very desperate operation †. I would not have you

† A gentleman of this city, in May 1762, by some accident struck his left hand through a pane of glass. A pretty considerable wound of the wrist was the consequence. The radial artery was also cut through, and some smaller ramifications were wounded. The arteries bled very freely; and soon after I was sent for, finding compression not answer cleverly in this case, he being a little heated with liquor, I took the resolution of making the ligature of these vessels, especially as it was after night fall. This done, the bleeding ceased, and I dressed the fores with soft lint, applying a cushion of tow to the bend of the arm, to break the force of the blood, which was secured by a proper bandage. The fore was not opened for two days after; and every thing went on in a very promising way. In about seven days the ligature dropped off; and I now recommended to him the greatest caution and temperance. He, nevertheless, made use of this hand on every occasion; and as my advice was not paid the deference I imagined due to it, I insisted on being discharged, which was complied with. For it was imagined I made much more of the affair than it deserved. But though the fore healed up, yet, in about three weeks after, upon some very violent effort, the radial artery ejected blood with great impetuosity; and I was again, with many entreaties, requested to visit him. I clapped a good deal of lycoperdon on this part, which I pressed on with my finger; over this a good deal of soft unformed lint, a compress over the artery, and secured the whole by a straight bandage; and, as the pulse was very full, took some blood from the other arm. Things remained thus for about five days; when, upon some excess, a fresh hæmorrhagy came on, which was again mastered. In two days more, it began again; on which I had Mr. Mahony, a good operator and surgeon, called in. The following morning it came on very violently; and, apprehensive that such frequent relapses would endanger his life, amputation became seriously thought of. I, however, told them I had one means more unattempted, before we should come to this disagreeable necessity; and the next day I had full occasion to put it to trial: For, on some very slight motion of the hand, it bled with great profusion, and I was sent for. In this situation, in the presence of the other surgeon, &c. I passed a convex needle, armed with three threads, smooth, flat, and well waxed, about three fourths of an inch higher up than the gaping orifice of the artery, and at some distance from this vessel; pierced the skin and fat, conveyed my needle under it, and again out at the other side of the artery; put some lint, between the spaces of the wounds, over the artery, and on this made a pretty tight ligature. All bleeding immediately ceased; the orifice of the artery soon healed; the skin became firm over this part; in about a fortnight after, the ligature cast off; and he now has the use of that hand as firm as the other. Thus by a *new, and truly curious operation, was a limb preserved; and will, I*

entirely ignorant even of this rude operation which O'Halleran, a very excellent surgeon, manifestly considers as new and ingenious, as a happy invention, which saved the person's life, and "which he thinks will be the means of preserving the lives of others."

I hope not. I hope that you will be able to save the lives of your patients on easier terms. There is nothing peculiar in this radial artery; the confusion arises from those causes which I have endeavoured to explain. The confusion of parts is from the driving of the blood! the temporary suppression of hæmorrhagy but increases the danger; and successive bleedings bring the patient to the brink of the grave, and have often occasioned the loss of a limb. There is no safety in trusting to compression, sponges, or astringents; for you are yourselves never free from anxiety, nor your patients from danger; the blood bursts out again, and all those intervals of expectation, and those apparent successes, only increase the difficulties of the case. To temporize is cruelty, and not mercy! for in the end it always comes to this, that you must make an incision, look for the artery, dissect for it till you are sure of your stroke:—You must use the needle, because you succeed best by dissecting upwards along the artery, and by putting your ligature round the artery itself, (and not merely by tying the open mouth of it). There is no artery of the body which you can dissect for more freely than the carpal artery; you should be able always to tie it without including, in your ligature, either the supinator tendon, or the Palmar Nerves.

This is my idea of the condition of a wounded artery, and these the practical inferences which I presume to deduce from this simple theory.—But there re-

hope, be, the means of saving many others in similar accidents. Had such a method been taken in the following case, a poor man might have preserved his arm.

I also deliver the following case from O'Halleran, to show you to what extremity this hæmorrhagy from the ulnar artery has sometimes reduced the patient.

"The butler to a gentleman at some distance from this city, about ten years past, in wiping a glass, it happened to break, by which accident he received a considerable wound of the wrist, in which the radial artery was divided. It bled violently, and with some difficulty was it mastered by Mr. White, an ancient surgeon here. The bleeding returned in two days—again in five; and thus continued bursting forth at times, on the least motion of the hand, for near a month. This great loss of blood having greatly fatigued and weakened the patient, on a consultation with the late Mr. Gould, amputation of the arm was resolved upon, and performed on the very next return, by Mr. White, in the presence of Dr. Martin; and the man soon recovered, but was rendered incapable of service."

mains a subject of inquiry still more important, I mean, the condition of a great artery when tied with a ligature, or reunited by compression; for that discussion is a necessary prelude to my observations on great aneurisms. Here, also, I am not afraid to acknowledge there is a connection betwixt theory and practice which it were hypocrisy to deny.

OF THE CONDITION OF THE ARTERY IN ANEURISM, AND OF THE EFFECTS OF THE
LIGATURES UPON THE ARTERY.

EVEN that aneurism, which proceeds from a direct wound of the artery, grows very slowly. When the brachial artery is wounded in bleeding, we find no tumor on the first day; on the second or third day the aneurism begins to form, but is then no bigger than a pea; it is small, round, hard, and circumscribed; and seems attached to the side of the artery: it is a week before it attains the size of a walnut, and a fortnight before it is as large as a pigeon or hen's egg; and it is only at the end of six weeks that it acquires the full size of an aneurism, such as is usually the subject of our operations.

The old physicians observing this slow growth of aneurism; seeing the tumor regularly circumscribed, and apparently attached to the side of the artery; imagining also, that they could press back the blood from the aneurismal sac into the canal of the artery, could not believe that this artery was actually wounded! they believed it to be merely dilated; they conceived that the point of the lancet had touched the external coat only; that in short the artery was pricked, but not wounded. They thought that the external coat being thus injured, the internal coats, no longer able to resist, the impetus of the blood had given way*; or they believed, that though the outermost coat of the artery when wounded may in time close again, yet the innermost coat being thinner, will not so easily

† "Quod in dilatata vena varix dicitur, in arteria preter naturam expansa aneurisma est." This is the definition with which Ruisch begins his case of aneurism; and the opinion here expressed was indeed universal.

submit to a cure as the other, seeing it is continually in danger of being further dilated by the impulse of the arterious blood.

This last opinion I have detailed from Purmannus, the celebrated Silesian surgeon, who ventures a step beyond his compeers. They only guessed that the artery was dilated; he pretended to demonstrate it! He not only delivers, in the following case, a formal narrative of the Brachial Artery, dilating from the diameter of a straw to the bigness of a man's head! "without breaking the vessel," which is no doubt "very wonderful to think of," but he is so adventurous as to give us a drawing of this sac, as if he had tied two ligatures round the artery, and cut out the intermediate piece, with this sac or dilatation as big as a man's head! One feels at every step how dangerous it is to receive, too implicitly, reports, which are inconsistent with common experience and common sense. The case is delivered by Purmannus in the following words:

"In the year 1680, I had in cure a gentlewoman at Halberstadt, named Anna Peters, about thirty-eight years of age, who had a large aneurism upon her left arm of three years continuance, the form and bigness whereof may be seen in Tabul. 5. fig. 11. This misfortune came by a chirurgion of Blanckenburg's letting her blood, who thrust his lancet through the vena mediana into the artery that lay under it, which caused a tumor of a vast bigness. At my first handling the pulse, I thought the blood run out of the artery between the muscles; but afterwards I found the contrary, and that it was an extension and dilatation of the artery; which certainly is a very great wonder to think upon, that a vessel no bigger than a straw, should extend itself to the bigness of a man's head, without breaking the vessel. This gentlewoman was not sensible of any great pain; but her arm was extremely wasted, and in a manner utterly dried up; which was very serviceable to me, for I could sooner find the artery; under both sides whereof I thrust a needle and silk, and tied it close together, and, cutting it through between the two tyings, took it out very happily and quickly, with the assistance of Mr. Kraue, a chirurgion at Quedlinburg; and the patient was cured in a month's time. Here I think myself obliged to acquaint you, that though this gentlewoman had worn several ligatures, compressors and leaden plates during the first year, yet it took its course, and nothing could have any effect upon it. The atrophica, or wasting of the arm, I cured with the balsam and mixture mentioned in the foregoing chapter."

There is hardly any author, indeed, who does not affirm the aneurism produ-

ced by a wound to be a true aneurism ; and the imperfect reunion of the internal coat of the artery to be the cause of the dilatation. Thus, Tulpius, in mentioning a wound of the artery of the thumb, with a very sharp pointed knife, says, " The external coat alone reunited, which being unsupported by the internal coat ! was unable to bear the force of the blood * ;" and even this breach of the internal coat, this " hiatus tunicae internæ arteriæ," they thought they could cure, and yet preserve the canal of the artery †.

Thus the old writers, who were rather speculative anatomists than practical surgeons, imagined these ingenious, but puerile, theories, which still hold their place in the systems of the present day ; their refinements upon this subtle doctrine are endless. De la Faye, in the following passage, not only compares the blood forcing the internal coat of an artery to bulge through the wound of the external coat, like a hernia of the abdomen ! but he pursues his speculation farther ; he adds, " It is important not to mistake this aneurism arising from a partial dilatation for that in which all the tunics are equably expanded ; for the former we often cure by compression, but the latter never ; because the whole circumference of the artery being dilated, if you press it on one side, it will protrude on the opposite side ‡.

They did, indeed, remark the jetting of the blood as a sign of wounded artery ! but they willingly forgot this decisive sign of a direct wound, in favour of their darling theory of dilatation. They boldly believed, that even that aneurism which proceeded from a wound of the lancet was but a dilatation of the artery. Thence came the scholastic distinctions of aneurisms, into true aneurisms, proceeding from a pure dilatation of the artery ; and false aneurisms, proceeding from a direct wound of the artery ; and mixed aneurisms, where a true aneurism had terminated in a false one ! or, in other terms, where an aneurism, consisting at first of a

* " Coalescit statim magis externa quam interna arteriæ tunica QUÆ MANSIT HIANS, ac a seinvicem se-jungata. Elevata propterea a vitali sanguine usque eo, externa ipsius membrana, ut degeneravit in verum aneurisma."

† " A plumbi lamina arctioreque vinculo ita depressum : ut expulso ex tumore sanguine et constricto convenienter vulneris hiatu facilius coiret, aglutinaturque interior lacerta arteriæ tunica," &c. page 305.

‡ Cette espece d'aneurism dont l'auteur parle est occasionnée par la division d'une ou plusieurs, tuniques extérieures et par la dilatation des intérieures QUI EN PASSANT PAR L'OUVERTEURE DES EXTERNE FORMENT UNE ESPECE D'HERNIE. Il est important de ne pas confondre cette sorte d'aneurism, avec ceux qui se font par la dilatation de toutes les tuniques ; car on la guerrit quelquefois par la compression, et ce moyen ne convient, pas ordinairement a ces dernières parce qu' en comprimant la tumeur, d'un, côté, elle croîtrait, au côté opposé. Page 697.

mere dilatation of the arterial coats, had been burst by violence, or had given way by over-distension, so as to pour out its blood into the cellular substance. Then it was, that surgeons conceived the romantic hopes of repressing those protrusions of the arterial coats, without interrupting the course of the circulation in the main artery; or entering upon a bloody operation which they did not understand; or endangering gangrene, which never was out of their thoughts: that gangrene! which has been so long the bugbear of surgery! They imagined, that even the wound from the lancet healed; and that the artery dilated from the injury done to its coats; they supposed it to be dilated from weakness; they compared this dilatation of the artery with the yielding of the peritoneum in hernia; and the dilatation of an artery like the protrusion of a gut, was opposed by a spring bandage. The artists who made bandages for hernia of the groin, made spring bandages for this imaginary hernia of the arterial coats, by the same rules and principles.

They were at the same time ignorant of all the laws of the circulating system; and full of this expectation of healing arteries by compressing the wounded point; and they were withal so fearful of this terrible gangrene, that they never ventured to perform the radical operation for aneurism. Ruisch was the first, in the great city of Amsterdam, who found courage to tie the artery of the arm*; and even he operated only after the aneurism had burst spontaneously! But to tie the artery of the arm higher than the bending of the arm, was esteemed a problem even in the days of Sharp and Cheselden. The older surgeons cured only by compression; their Annulus Ferreus was a great spring bandage for compressing the dilated artery; they made their patients wear these awkward and uneasy instruments sleeping and waking for a full year, before they ventured to pronounce the cure perfect; and then they applied their Scutum Eburneum, an ivory compress, upon the artery! a sort of defending bandage, which some patients, for fear of future dilatations, wore for life.

When the celebrated Heister had obliterated a wound of the femoral artery, or to speak more correctly, had obliterated the femoral artery itself, by puff-ball, gradu-

* Unanimiter cutis incisionem et arteriæ constrictionem commendavimus. Operatio sane ab actoribus magis commendatum et laudatum quam institutam; quod dicere non gravior quia viginti abhinc annis et quod excurrit, in hac vasta civitate, ad quam sine numero confluent afflicti hanc operationem in arteria adeo ingenti nullus quantum noverim chirurgorum instituit. Ruisch, page 5.

ated compresses, and a very firm rolling of the limb, we find him expressing the same fears about the dilatation of the artery, and taking every precaution to prevent this accident. Before he removed those compresses, by which the wound had been healed, he had others ready of a peculiar construction, to prevent this dilatation, which, according to the doctrine of that day, was likely to follow such a wound. His fear was, lest the new and soft cicatrix of the artery should, in the soft condition, give way and dilate, ("adhuc sollicitus de aneurismate avertendo, Subovatam laminam quando metallicam diu gestandum lausit, ut sic recens nimisque mollis tunc adhuc arteriæ cicatrix, donec probe induretur, compressa servetur.") He imagined even a wound of the great femoral artery to be healed by compression. He imagined the wounded part of the artery to have a cicatrix too soft and delicate to bear the current of the arterial blood! He imagined that it was necessary to guard against such dilatation, by an oval compress of metal, bound upon the thigh with a leather belt; and worn, as we find by this particular patient, for life*.

At last they ventured to open the aneurismal tumor, and clear the sac of blood; but it was not for the purpose of performing the radical operation;—they did not venture to follow the Arabian practice of tying the main artery, and cutting it across, so as to let it shrink into the flesh. Their doctrine of dilatation was still inviolate; and they stuck to their practice of compression; they cleared away the blood, sought out the wound of the artery, clapped a pellet of chewed paper upon it, and piled compresses upon this first compress of chewed paper. Thus they believed that they cured the wound in the artery by adhesion;

* "Denique cum ad finem fere curatio pervenisset Ill. Dn. Præses, uberius adhuc sollicitus fuit de aneurismate avertendo, id quod alias facile, licet ejusmodi vulnera etiam sanata sint, postea adhuc supervenit (1). Ad hoc vero præstandum, non solum subovatam laminam quandam metallicam, quinta vel sexta deligatione, ut modo § XXXIII. diximus, vulnere superimponi curavit, verum etiam machinam aptam coriaceam ægro proposuit, quam ipsi, sanato etiam vulnere, circa locum vulneris diu gestandam suavit, *ut sic recens nimisque mollis tunc adhuc arteriæ cicatrix, donec probe induretur, compressa servetur*: 'quia alias facile, nisi sic impediatur, aneurysma periculosum sequeretur.' Hoc cum vulneratus intelligeret, ipse sibi hujusmodi machinam confecit, quam fig. 2. et 3. exhibemus, et quæ ita se habet."

This patient, who made the bandage for himself, according to Heister's direction, was a shoemaker, who had wounded his femoral artery with the paring knife: And Andreas Reinig, who relates the case, adds, "Hoc vero solum adhuc indicare volui quod vulneratus hac machina adhuc dum utatur."

We find the celebrated Mr. Foubert, about forty years ago, modelling a new compressing machine after the plan of those of Dr. Bourdelot, and of Scultetus.

and, when this method failed, they were so fearful of interrupting the main trunk of the artery, that rather than tie it they scrupled not to cut off the arm or thigh as their last resource *.

We cannot pretend to say what are the expectations of modern surgeons in respect to this reunion of the lips of a wounded artery; but if we may judge from books, the doctrines of true, false, and mixed aneurisms are in full force at this present day. There are many weak men ready to believe, that the aneurism which follows bleeding arises merely from a wound of the external coat of the artery; and there are many truly great men who believe, that the absolute wound of an artery may be united by compression; we find even Desault, the celebrated Desault, healing wounds of the brachial artery with pellets of chewed paper. The recovery of a limb, whose main artery is wounded, is still reckoned doubtful; and surgeons, fearful lest the anastomoses of the articular or collateral arteries should not be sufficient to save a limb, are to this very day anxious to discover some new operation by which the wounded artery may be cured, and its canal preserved pervious. The late Mr. Lambert ventured to perform the operation of the hare-lip future upon a wounded brachial artery; and I confess that I was so imprudent as to repeat this experiment myself; but this honest avowal of my ill success will, I hope, be esteemed a sufficient compensation for any rashness I may be thought guilty of; and let it be remembered, in extenuation, that this operation had been boldly proclaimed successful †.

We may venture to affirm, that nothing has been more unfavourable to the improvement of our science than this traditionary nonsense, delivered down

* Our own great surgeon, Wiseman, seems to have been the only one who was bold enough, or sufficiently accustomed to dissection and actual operations, to withstand this favourite doctrine of true and false aneurisms. He alone thinks and judges for himself. He speaks from his experience in operations. He contradicts it flatly. He says, "This I was taught myself, and some while believed; but not having been able by my practice to discover one aneurism made by dilatation or relaxation of the outward coat, I am apt to believe there is no such thing, but that it takes its rise from blood bursting quite through the artery into the interstices of the muscles, where it raiseth a tumor suitable to the cavity, growing bigger or less, of this or that shape, as the muscles give way. But this tumor consists of blood extravasated, the artery lying undilated the while. I do therefore suspect the possibility of an aneurism by the dilatation of the outward or softer coat of the artery; because it seems improbable that a force big enough to burst the inward coat, which is so tough and firm, should leave the exterior, being softer and weaker, whole, and go out so leisurely into it as to give it time for dilatation. Those which I have met with did all come from downright eruption through both the coats."

† I shall have occasion to mention this operation presently.

from one system to another, passing from hand to hand, among formal book-makers, "*unum alterum insequentes sicut grues**;" who fly all in a row like geese. This imaginary wound of the external tunics, with dilatation of the inward coat of an artery; these scholastic distinctions, of true, false, and mixed aneurisms; these uncertain reports, about curing aneurisms by compression; and this vain expectation, of healing a wounded artery, by reuniting the lips of the wound, have not as yet been replaced by any true pathology of a wounded artery.

OF THE WOUND MADE BY THE LANCET.

First, It must be observed, that an artery is not pricked merely in its external coat; and the proof is this: Our legislature does not prevent the most ignorant from meddling with a profession, which should be sacred as the priesthood,—masons, butchers, gardeners, cow-herds! are among the chief phlebotomists in this country; and it is to them that we are indebted for the various specimens of aneurism. They use very blunt lancets; and a blunt lancet being pushed rudely onwards starts through the skin at last, and strikes deep into the arm. The aneurism is generally produced by a very large and rude wound, like that which the point of a penknife would make. I have seen many such aneurisms, and operated on several; once, when the operation was performed by another gentleman, I saw the artery so wounded, that it was held together merely by a tag; the cut in it was indeed oblique, but so large that it had severed the artery almost entirely across. In an operation which I performed myself, I proposed using only one ligature, being well assured that a single ligature, applied round the wounded part of the artery, would obliterate the artery to a considerable extent, above and below; but, upon opening the sac, I found the slit in the artery so very long, that I was forced to apply two ligatures in the usual way. In another operation, I found the great artery running over the fore part of the tumor, and beating strongly; I ventured to prognosticate, that, upon opening this aneurism, we should find either the brachial artery dividing high in the arm, or the artery so transfixcd as to allow the blood to pass all out by the back of the artery; and accordingly, upon opening the arm, we found the artery entirely

* Guy de Chauliac

transfixed ! When I passed my probe into the artery, it passed through the other side, and the artery hung suspended over the probe. The artery had been transfixed with a terrible gash ; the pressure of the compress and bandage had hindered the blood from coming out from the greater wound on the fore part of the artery ; it had all gone out from the smaller wound on the back of the artery, the blood of course was collected behind it, and the artery was so raised upon the fore part of the tumor, and so presented to the operator's knife, that, had the aneurism been opened rashly, it must have been cut across. From these descriptions, and the difficulty of stemming the blood at the time of the accident, and the rudeness of the people by whom this fault of striking the artery is committed, we have reason to believe that it is wounded always with a very rude gash, and sometimes absolutely cut across.

Among surgical writers, I find frequent and undeniable proofs of the fact which I have here affirmed ; I have observed, that, in proportion to the largeness of the wound, is the size of the aneurismal tumor ; I have never observed any aneurism increase so rapidly as to threaten bursting, except those in which the wound of the lancet was singularly large ; we have few cases of aneurism absolutely bursting, except those related by Ruisch and Saviard ; in the one the artery was entirely burst by a violent exertion of the arm ; in the other (in Ruisch's I mean) it was cut across with the lancet. And in this case mentioned by Ruisch, the aneurism appeared at first no bigger than a large pea, (so firmly do the parts resist the artery even when it is wounded) ; but it grew sensibly from day to day till it burst at last, (so powerfully does the artery act when largely wounded). That this artery was largely wounded we must presume from the narrative which follows the case ; for the surgeons having stopped the immediate flux of blood with bovista and compresses, proceeded then to their radical operation of tying the artery ; and, upon making the incision, and scooping out the blood, the blood flowed from two separate points ; by which it would appear that the artery had been absolutely cut across : (" Multum cruoris per-vulnus aneurismatis expressit, et porro brachium secundum longitudinem sat profunde incidit, ut sanguinem coagulatum levi compressione facta auferret, et gangrenæ eo commodius opem ferret. *Hoc facta incisione sanguis arteriosus, duobus e locis magna vi erupit,*" Ruisch.) In short, the fact is so plainly affirmed in this paragraph, that unless we are to suppose such a surgeon as Adrianus, assisted by such a counsellor as Ruisch, to have gone to

work so very unskilfully, as to have cut the brachial artery across during the operation with the knife, we must allow the artery to have been entirely divided by the lancet*.

The celebrated Guattani considers a false aneurism, or, in other words, a true wound of the artery, as a rare accident; he, as well as the older surgeons, explains the aneurism arising from the puncture of the lancet, as arising "from a wound of two or more of the five coats of which an artery is composed; the internal coat being of course no longer able to sustain the impetus of the blood†; and yet we find in the book of Guattani a wound of the brachial artery as deep as can be imagined, the artery certainly transfixed, and the case resembling, in all its essential circumstances, that which I have just mentioned. "In one patient, says Guattani, I found the arm so crooked, and with such an inveterate rigidity of the biceps, both from the posture of the arm, and the incessant application of strong spirituous fomentations, that there was no extending the arm so as to get at the artery to tie it, nor any way of saving the patient but by cutting off his arm, which I did upon the 27th day, assisted by the celebrated Pietro Javina. Having got the arm carried home, we proceeded to examine it, and happily discovered the cause of this singular difficulty, both in finding and in tying the artery; for the artery, far from lying in its natural situation, was entirely displaced by the extravasated blood which raised up the whole bend of the arm in the form of a tumor, and pressed the trunk of the artery so before it as to lay it close against the internal surface of the skin‡."

This was surely a case similar to that which I have just described. The artery

* The artery being cut almost entirely across, is, I am persuaded, a very frequent accident.— "Neapoli, 1644, Mense Martio quum venam sibi jussisset secari, arteriæ passus est incisionem, sequutum aneurisma quo neglecto abscissum brachium; visus illo abscisso MAGNUS ARTERIÆ HIATUS adhuc adversus alas superstitis." Boneti, Tom. III. Appendix, "De infelice aneurismatis apertione." In those days they made quick work with arms they injured in bleeding; they cut them off, and might have had very fine Museums, if it had been the taste of the times.

† "Si ferri mucro ad cavum usque haud pertingat sed ex quinque arteriam componentibus tunicis, duas tantum vel tres confodiat, verum progignitur aneurisma. Arteriosus sanguis integras adhuc membranas jugiter feriens eas, peditentem ita distendit, ut berniosa tandem reddantur; post dies aliquot, hebdomadas, vel etiam menses prodit aneurisma," &c.

‡ "Deinde quum domi meæ vulneris statum ambo in arteriæ perscrutamur, in maximam incidimus illam, cum inveniendi, tum quoque vinciendi difficultatem; hæc enim arteria non amplius in consueto manebat loco, verum ab illo prorsus recesserat ob effusum concretumque sanguinem, qui eam sursum propulerat usque ad internam cutis atque pinguedinis faciem, concretam tegentem sanguinem in cubiti flexione quæ tota in tumorem tollebatur."

had been not merely wounded, but quite transfixcd with the lancet; the blood had been poured out upon the back part of the artery; the artery had been raised over the fore part of the tumor, and had lain immediately under the skin. I conclude also, that this was one of the most favourable cases for operation; for the wound of the artery was so wide, the artery was so far displaced from its proper situation, it was so stretched over the surface of the tumor, and so flattened by pressure, betwixt the tumor and the skin, that it could be of no use in nourishing the arm; the arm then was nourished chiefly by its inosculating branches; and this I am entitled to affirm, from having observed, that where there is little blood passing in the main trunk of the artery, there is much circulating in the collateral arteries; that wherever the trunk of the artery has been deeply wounded, the pulse has been proportionably weak before operation, and has returned immediately after the artery was tied. In one case only have I seen blood run from the lower end of the divided artery; and in that case the artery was very nearly divided across*. This is one of the many cases in which the arm has been very rashly cut off, and this pricking of the artery, with a wound of its outer coat only, is an imaginary accident.



WE CANNOT REPRESS THE BLOOD OF AN ANEURISM.

2dly, It is not less imaginary, that the blood can be pushed back from the aneurismal bag into the artery! there is no such thing, it is a mere delusion; there is

* The rigidity which (in this case of Ruisch's) was attributed to the astringency of the spirituous embrocations, was owing merely to the tenseness of the fascia; for the whole of the bend of the arm was raised into a tumor.

one case only, viz. the aneurifmal varix, where this can be done: The aneurifmal varix is a complicated aneurism, where the artery and vein, being both wounded, have not healed apart, but have adhered, a free communication being formed betwixt the artery and vein; the vein is dilated by the pulsations of the artery, the blood is still circulating and fluid; it may be pushed onwards in the veins, and might be pressed back into the artery. When this kind of aneurism is emptied, the artery is perceptibly felt filling the bag with a distinct pulsation, and a sort of whizzing noise; but in the proper aneurism no such thing can happen; the blood is firmly coagulated. I never found, in an aneurism of six weeks standing, any fluid blood! It was all grumous and lumpy; and the clots which obstruct the mouth of the artery were peculiarly firm. It does not appear to me that the aneurism of the arm distends regularly and gradually, but like a bleeding artery, it bursts out from time to time with an internal hæmorrhagy.

Aneurism is more frequent among the lower ranks, especially among labourers. A poor man having refrained from labour for a week or more, is tempted to begin work again for the support of his family; he works for a day or two, the tumor is perceptibly enlarged after each exertion; the blood is then evacuated into the cellular substance, by successive internal hæmorrhages; till, at the end of six weeks, or two months, the arm is quite benumbed by the compression of this accumulating and condensed blood, and the operation is submitted to; but the blood thus successively effused is firmly coagulated, and we find the particular clot, which closes the slit in the artery, as firm as the gizzard of a fowl. I conclude, that we cannot reduce the blood of an aneurifmal tumor; first, Because it is coagulated; secondly, Because the wound of the artery is slit-like, and acts like a valve; thirdly, Because if we did press the blood back into the artery, we should feel the bag in some slight degree flaccid, and should feel the action of the artery when it filled the tumor again; fourthly, Because I have noticed, that in those very aneurisms, where many gentlemen in consultation declared, that, by pressing long and dexterously, they had reduced the size of the tumor, upon opening the aneurism, I have found the whole contents of the tumor grumous, without one particle of blood in the aneurism fluid enough to be returned into the artery, although the opening had been quite favourable to the receiving of it; fifthly, I do not think the pulse at the wrist could be so firm as we often feel it, unless the artery were perfectly closed by that particular clot, which plugs up the slit; and that again kept firm, by the general pressure of the

grumous blood behind it. I do not then reckon the returning of the blood into the artery among the signs of aneurism, whether old or recent; the appearance is a mere deception; every surgeon must recollect, that by pressing firmly upon any tumor, he can sink it into the cellular substance, and reduce its apparent size; and it is particularly easy, by pressure and working, to flatten an aneurismal tumor; for pressure drives the blood more widely into the surrounding cellular substance, flattens the tumor for a moment, and seems to reduce its size; while by working the blood aside, it really makes room for more extravasation, and increases the size of the aneurism. Of this I have seen some very imprudent examples.

THE WOUND IS CALLOUS AND WILL NOT HEAL.

3dly, It is not less imaginary, that such a wound could heal by adhesion, so as to preserve the continuity of the arterial canal; for the arterial coats are, in their nature, hard, unyielding, and callous; a clot is usually interposed betwixt the lips of the wound; the blood runs freely along the canal of the artery, ready to flow through the slit upon the slightest exertion of the arm, or slightest motion of the clot; and there lies a considerable collection of blood betwixt the wound of the artery and any compress that we can apply!

And when after the aneurism has lasted some weeks we perform the operation, and open the tumor its whole length, we find the opening of the artery with inverted edges, if the slit be as large as I have generally seen it; or, if it be small, it is like a pie-hole; or, as the late Professor Monro describes it, very happily, "it is like a hole struck in a piece of leather with a punch *."

* When the wound of the artery is small, and the aneurism is formed; the lips of the wound in the artery heal; it is this which gives the circular appearance to the orifice, which is well described a hundred years ago by Wiseman. He relates the case of a man whose artery was wounded in bleeding. He had applied a laced glove and sheath for the arm in hopes of lessening the tumor, and pushing back the blood into the artery, and he had in some degree succeeded; but the patient grew weary of these methods of cure, and "gave ear to every prattle, and fell into the hands of an empiric, who, while he tried to cure it with herbs, &c. so softened the tumor, that he made way for the blood to burst forth abundantly. The surgeons who were first called made a shift to stop the blood; but the arm gangrened; they cut it off. Wiseman went to see it amputated; after amputation they slit up the arm, and laid the artery bare; it retained its natural shape and smallness, not one jot dilated; nor was the apertion considerable which had

Yet Mr. Lambert of Newcastle, notwithstanding this callosity of the artery, ventured to expect success in sewing those callous lips together, and he succeeded. I performed the same operation, and failed; I opened the aneurism, hooked out the clots of blood; and then raised the artery upon my forefinger; I took next a very fine bleeding lancet, and scarified the two lips of the wound; after having made them raw, I passed a very delicate glover's needle through both the lips of the wounded artery, and twisted a fine cambric thread round the needle, so as to draw the lips of the wound close. Upon letting go the tourniquet, the artery was seen beating in the bottom of the wound; the pulse in the wrist became instantly as strong as in the other hand; indeed we thought this artery beat rather more powerfully. Every thing went on well till the twelfth day; on that day I was obliged to go out of town; a dangerous hæmorrhagy came on in the evening. On the fourteenth day the bleeding returned; I was still out of town, and the artery was tied with the two ligatures, as usual, by the late Dr. Aitken. It was insinuated, that had I been with my own patient, the operation might still have succeeded; but I am sure it failed from natural causes, and that whatever faults might be imputed to the late Dr. Aitken, want of enthusiasm in his profession was not among the number; I know he would have been delighted to see me succeed, and he actually assisted me in the operation with a degree of zeal which was very honourable to him.

In reflecting upon this operation, I have sometimes thought that it must have failed, from the needle being struck too deeply into the coats of the artery; that it might have succeeded had the needle been struck only into the mere cellular coat which surrounds the artery, in which case the needle would have come early, and safely away. I was, happily for my own ease of mind, not aware of the dangerous situation of my patient for those fourteen days;—but, now that we are aware of this danger! sensible that the patient, if not carefully watched for a fortnight, may die in a moment of time! who will venture to repeat the experiment? Besides, we are now so little apprehensive of gangrene, from want of circulation, that our motives for repeating this dangerous operation are very slight indeed.

been made by that accident, *but, by reason of its constitution*, continued open, as I have seen a hole punched in leather." Wiseman, page 126.

COMPRESSION OBLITERATES THE CANAL OF THE ARTERY.

4thly, That the old operation of compressing the artery did not cure by reuniting the wound, and preserving the canal of the artery, is to me very clearly proved by the manner in which they achieved this tedious cure. To satisfy you that I argue correctly, I will state to you one of the most remarkable and best authenticated cases of this kind, that stands upon record. At the very time when all the surgeons in Europe had begun to take a particular interest in this disease; while they were still fearful of gangrene, and anxious to have some absolute proof of the disease being curable by compression, it happened that Bourdelot, physician to the Queen of Sweden, was struck in the brachial artery.

"My artery," says Bourdelot, "was pricked, in the bend of the arm, where it runs under the median vein, though I had at the time remarked to the surgeon the pulsation of the artery, and advised him against bleeding there. When I saw the blood fly, per saltim, I applied graduated compresses, and kept quiet for some time; the outward wound indeed soon healed; but in no long space I perceived a small tubercle rising, which increased in spite of my endeavours to repress it. I now was convinced that styptics could not penetrate the skin, for thick compresses dipped in styptics had been of no use."

"The aneurism attained the size of a small hen's egg; but I accomplished the cure in the course of a year by applying a round compress, bound firmly down upon the aneurism with thongs, which turned round the elbow above and below, and were adapted to any requisite degree of compression by holes in the straps, which hooked upon small buttons. The scutum was pressed deep down upon the artery, while the blood was allowed to pass along the veins towards the heart, by the sides of the compress, (in the angles made by the straps of the bandage with the cushion). The fretting of the compress I obviated by dipping it from time to time in a solution of alum in salt water."

"There remained not in my arm the smallest mark of the tumor; but for two years I was sensible of a degree of constriction round the wound, and along the course of the artery; the hardness I thought never would have disappeared, for the artery had acquired a solid and tendinous firmness; but that also was in due time entirely dissolved, not leaving even the mark of a scar; and though the

shield or compress left a sort of hollow in the bend of the arm; that also, in the course of a few months, disappeared. The dilated arteries and veins, which supplied the place of the main artery, contracted again *as soon as the compress was removed, and the blood allowed to flow in its usual channel* *."

This case contains in it every possible argument against the conclusion which it was meant to establish. We may here observe, that it is not so easy as was imagined, to heal the wound in an artery even in the most favourable circumstances; for Bourdelot, the moment his artery was wounded, was fully sensible of what had happened to him; he instantly applied his compress and bandage, with all the precaution which an interest in his own situation, and the fear of a disease, much dreaded in those days, could suggest: There would, I dare say, be no slackness there! nor any want of attention to the state of the bandage! yet he could not oppose the artery, he could not heal this wound even when it was recent, the lips just divided, and the parts not yet injected with blood!

But perhaps after having got the proper bandage made, he may have prevailed so far as to heal the artery? This I think still less probable; for when he began to apply the proper bandage, the aneurism was fully formed, and a week, or rather a fortnight, had elapsed from the time of the wound, before he applied his scutum or compress, so that the lips of the wounded artery must have become

* "Incisa mihi fuit arteria in flexura brachii dextri, qua sub vena mediana decurrit, quanquam a me monitus fuisset Chirurgus ibi loci pulsare arteriam; Ubi animadverti sanguinem ea ejaculari ad singulas pulsationes, plurima splenia adponi curavi, ac longa quiete usus sum; cutis prompte coaluit, ac cicatrix exterior cito genita est, interim ad aliquod temporis spatium tuberculum quoddam eminebat, quod paulatim incrementum habuit, irritis quibusque remediis."

"Denfissima splenia, aquis stypticis imbuta, opem nullam afferebant, cujus rei ratio paulo post mihi innotuit; aquæ vis quinque integumenta pervadere nequit."

"Id quo affectus fui magnitudinem attigit ovi junioris gallinæ, Curationem obtinui intra anni spatium, tumor in dies minuebatur, adplicato scuto rotundo, cuius lora non procul a cubito, supra et infra ducta cohibebantur ope fibulæ clavi: Lora prædicta, exiguis foraminibus pertusa, ad constrictionis vel relaxationis facilitatem, vacuum spatium concedebant redeunti sanguini, ad cor emissio per venas, tanquam infra ponticulum: Scutum profunde arteriam contingebat, paucam superficiem occupans, exiguumque pruritum inducens, cui obviam ibam scutum immergendo aquæ salæ imbutæ, in qua alumenustum dissolutum fuerat."

"Brachium, qua parte tumor enatus fuerat, nulla illius gerit in me vestigia: Duorum annorum spatio in arteriæ totius corpore superstes, fuit sensus, circa vulneris locum, quasi constrictionis a spira, et cicatricis: *Duritiam nunquam cessuram credidi, arteria enim substantiam obtinet nerveam et solidam, attamen dissipatio omnimoda consequuta est, ne supersite quidem cicatrice*; In flexura brachii a scuto effecta erat fovea, at intra trium aut quatuor mensium spatium oppleta illa fuit, existimo arteriolas et venulas humeri, quæ vices supplebant

callous; besides a tumor as large as a pullet's egg was then interposed betwixt his compress and the artery; "he supposes the blood to be gradually pressed back from the bag into the artery, the bag yielding before the compress like a sponge, and emptying its blood into the artery *." Even granting this hypothesis, we must presume a long time to have elapsed before the edges of this wounded artery could have come into contact; by which time they must have healed apart! and have been past all chance or possibility of adhering together.

Since then his machine could not reunite the artery, and yet did actually cure the aneurism; the next important question is, How and by what natural process was the cure achieved? Let it be observed, that this tumor was many months of disappearing, or even of lessening. That an aneurism is one of the most firm and solid of all tumors, being hard crammed with coagulated blood. Such tumor then is pressed against the artery, the artery is flattened betwixt the tumor and the bone, the circulation in the main channel is interrupted, and the collateral channels are enlarged till they become able to support the arm, and supply it with blood; when these lesser arteries are so enlarged, and rendered active, as to work the blood forwards, it not only forsakes the main trunk, but has a tendency to continue in this new rout! The main artery is forsaken of the blood, its sides are kept in close contact, they adhere to each other, and the artery becomes like the hypogastric arteries or umbilical vein, a firm cord †.

arteriæ læsæ, de qua verba feci, et in amplitudinem diductæ erant, coarctatus fuisse et in nihilum redactas, concessio meatu sanguini arterioso per canalem solitum, insigni arteriæ trunco aperto manente et libero."

* "Si qui a me quæsierit, quo tandem abit id tegmen seu contextus, sanguinem aneurismatis continens, si quando hoc omnino sanari contigerit, ac pars ad eundem omnino statum redierit quem obtinebat ante inflicto vulnus? Respondeo id evanescere, tanquam spongiam ut compressionis a scuto factæ, id quod inde exprimitur influere in arterias."

† In reporting the facts concerning this case, in which all Europe was at that time interested, and which was indeed the precedent for many very dangerous inventions of spring bandages, and other compressing machines, I take my report altogether from the original letter to Bligni, the Foart Limmous of those days. This I take to be the true story. I will hardly condescend to take notice of the trifling conceits which came into the heads of other surgeons concerning this bandage, and its mode of operation. Bourdelot himself says not one word about this compress being in the form of a bridge; if he speaks of the blood passing freely along the veins, while the artery singly was compressed, he ascribes this not to the peculiar form of his scutum, shield, or compress, but merely to that interstice which was necessarily left betwixt a high towering compress, placed upon the top of an aneurism, and the straps which buckled round the arm, and which went over this towering compress. Yet Dionis (who I suspect could not read Bourdelot's letter because it was not in French), calls his compressing instrument "Ponton," "a Bridge compress." He

This is truly the operation which they performed with their compresses. We have every proof we could desire of the process being complete in this case; for we find Mr. Bourdelot remarking, that the artery in his arm had acquired a degree of solid and tendinous hardness, never to be dissolved, as he believed; "*Duritiem nunquam cessuram credidi; arteria enim substantiam obtineat nerveam et solidam,*" &c.

I am persuaded these old physicians accomplished with their compress exactly the same operation that we perform with the needle; they obliterated the canal of the artery; and, had they understood the pathology of this disease, or the effect of their own operations, they would have been able, I am persuaded, to have described to us the period of coldness and of interrupted pulse, and the manner of its return, just as distinctly in their operation by compression as in ours by incision; and certainly, had they succeeded as they imagined they did, viz. by dissolving the tumor and healing the wounded artery, they would have told us, in place of this *duritiem nerveam et solidam*, how the pulse was felt in the bending of the arm as distinctly after the cure as before the artery was wounded. They would have compressed the artery only till they had obliterated it; and then have left the absorption to nature; but would not surely have continued this severe bandage for years*.

PELLETS OF CHEWED PAPER APPLIED TO THE OPEN ARTERY DO NOT HEAL BUT OBLITERATE IT.

5thly, When long ago every surgeon was in the practice, after opening the aneurism, of closing the wound in the artery with a pellet of chewed paper, is it likely

describes the compress as having a groove in it, which, while the rest of the compress had its full effect upon the tumor, allowed the blood to pass along the artery in this groove as the waters of a river do under a bridge. "*Quoyque cet écusson soit fait pour comprimer la tumeur, il y a une canelure pour laisser la liberté au sang de l'artère de passer par dessous. C'est ce qui luy a fait donner le nom de ponton, étant semblable à un pont qui n'empêche pas l'eau d'une rivière de continuer son cours: il le porta l'espace d'une année, et la tumeur diminuant tous les jours il se trouva guéri entièrement.*"

* We cannot help being surprised to find even the celebrated Deseault, after having cured a little girl of aneurism by compression, say not one word about the obliteration of the artery, nor yet mention its remaining pervious, a fact which he might have easily ascertained; for the girl was six years old at the time of the artery being wounded with the lancet; she wore the compressing bandage for a year! and she was fifteen years old at the time of writing the case!—Vid. *Journal de Chirurgie*, page 37. Vol. II.

that the lips of the wounded artery were made to adhere? Having myself failed in reuniting the lips of a wounded artery, I am very little inclined to believe that a rude pellet of chewed paper, graduated compresses, and a firm bandage over all, could do any thing but obliterate the canal of the artery. We do indeed find Garengéot describing, with all imaginable confidence, the appearance of the artery at the point where the wound of it was healed up by the chewed paper; but I believe he was just making that experiment on the credulity of his reader, which cost him less, perhaps, than most other authors. He wished to say to his reader, "You will, as soon as the compress falls off, see distinctly the cicatrix of the united artery!" but, with all his effrontery, he could not bring himself to this. He says only, "As soon as the lint and the pellet of chewed paper fall off from the artery, you will remark a white space where the beating of the artery is more intense! that is, the very place where the wound was, and you must not leave it uncovered for a moment, but put a large compress upon it, powdered with rosin and whatever else may promote the generation of flesh round the artery †."

Garengéot is an author in whom we can have no confidence; we find him writing by mere conjecture about many interesting points of pathology; but there is a more respectable author, Mr. Morrand, who also believed that he cured arteries by compression. He was in the practice of opening the aneurism, and of putting down a piece of sponge or agaric upon the wounded part of the artery, heaping compresses above the agaric, and binding the whole very firm with rollers. Speaking of one particular case, he says, that he cured an artery wounded with the lancet in a manner very different from that where the ligature is used. "I need not, says Mr. Morrand, mention the several precautions which I took after applying Mr. Broffard's agaric to the artery." I shall only observe, that the pulse, which was interrupted for twenty hours, returned at the end of that time, and that I cicatrized the wound in a month." "Je dirai seulement que le poulx intercepté a la main pendant environ vingt heures, se manifesta au bout de ce temps la, &c. p. 168.

All those surgeons who have used the compress, sponge, or agaric, believed

† "Quant la charpie est tombée et le petit morceau de papier mâché, on apperçoit à l'artère un endroit blanchâtre où le battement paroît plus sensible: c'est-là l'endroit où étoit la division, qu'il ne faut pas laisser long-tems découvert, mais appliquer promptement dessus un bourdonnet assez gros, saupoudré de poudre de thérebentine sèche, &c. afin de faire venir de bonnes chairs bien solides autour de l'artère, et le reste de l'appareil comme je viens de le dire."

that they healed the wound of the artery ; but you, I dare say, have a more correct idea of what Mr. Morrand was doing with his puff-ball, and what this interruption of the pulse means. He had entirely compressed the artery, laid its sides in contact, and obliterated its canal ; the pulse was for twenty-four hours interrupted, the collateral arteries were enlarged, the pulse returned ; the operation, in short, was essentially the same with that of tying the artery *. This gentleman, whose artery Mr. Morrand thought he had healed by pressing a piece of agaric upon it, had the artery wounded with a sword, a kind of wound which should not be easily cured by the reunion of its lips. But we find in Morrand's paper a still more decisive fact than this : He had cured two others of aneurisms in the arm by applying a bit of agaric to the wounded artery ; and in those two cases the pulse did not return in one till the fifteenth, nor in the other till the seventeenth day." An artery completely flattened and compressed for seventeen days ! certainly was not healed but obliterated.

So little did these old surgeons understand the effect of their compresses, that they imagined that their success depended much upon the astringency of the liquor in which the compresses were dipped, and their astringent liquor was usually a diluted caustic ! Webber applied butter of antimony to the wound of

* We find, in the following transcript from Murray, two very singular things : In the first place, We find two patients allowed to die of bleeding, during the night, after some awkward attempt by the surgeons of the hospital at curing the aneurism of the arm, in which, according to the oldest fashion, they had tried compression not above the skin, with the hopes of saving their patients from the pains and horror of a bloody operation ; but had first cut up the aneurismal tumor, and then, instead of tying the artery with a ligature, had applied a compress, and applied it so insecurely, that both the patients, from some unwary motion in sleep, had bled to death during the night. This is his fact ; and his opinion, as it is plainly implied in the following words, is very curious. " If your compression be too powerful, in place of saving the artery, you will absolutely obliterate the artery ; but if you compress lightly with design of saving the artery, you are never out of danger of an alarming, or even fatal hæmorrhagy." This language very clearly implies, that Murray, like most others, expects from compression, not an obliteration of the artery, but thinks, as Heister did long ago, and Mr. Morrand more lately (Vid. Acad. des Sciences, Vol. V. p. 172, Octavo.) that the compress, by suppressing the quick motion of the artery, heals the wound.

Murray speaks thus : " Frustra itaque, si firmam compressionem instituimus, conservationem arteriæ expectamus, in leviori autem, qualis ad scopum obtinendum requiritur, hæmorrhagiæ repetitæ quæ chirurgi animum quam maxime sollicitant, atque etiam ægrum ad ultimam sæpe metam detrudunt, vix evitari possunt, leviori sub somno, motu brachii, quo compressio aliquantum fuit perturbata, binos ægros Montispefulani vigesimo post operationem die, hæmorrhagia exitiali correptos fuisse, narravit cel. Præses. (viz. Murray.)"—Vid. Arvidson Murray, p. 20.

the artery in aneurism of the arm; and Garengéot trusted not so much to his compress of chewed paper as to the liquor he dipped it in, which was not a mere astringent, it was a caustic, and a quackish one, which he had the meanness to conceal, (" Pour cet effet les opérateurs d'aujourd'hui se *servent du caustique*, ou de la ligature. Si l'on prend le parti du caustique, voici la pratique la mieux reçue. D'abord que l'ouverture de l'artère est bien découverte, je prens un morceau de papier brouillard mâché et exprimé; je le trempe ensuite dans *un caustique liquide, que je préfère à tous les autres caustiques*, je l'exprime fortement de peur, &c." Garengéot, p. 246.) And Asman plainly recommends buttons of vitriol to be applied to the wound in the artery. (" Imponantur vulneri Globuli pisi magnitudinis ex vitriolo Cyprino ad albedinem Calcinato Gossyppio probe involuti." " Globulos vulneri arteriæ proximos tamdiu relinquendos esse donec sponte decidant.") Thus we perceive, not only that naked buttons of vitriol were applied to the wound of the artery, but kept there till they produced floughs. What could actual caustics like these do but obliterate the artery by inflammation, or destroy it?

AT THE MOMENT OF THE WOUND THE ARTERY MAY BE HEALED.

6thly, There is just one moment of time * in which it is possible to succeed in reuniting a wounded artery, and it is the very case in which Bourdelot failed. In a recent wound, where the surgeon is sensible of the artery being wounded, it is possible to heal the artery before the aneurism is formed, before any tumor of blood is interposed betwixt the compress and the artery, before the cellular substance is crammed with blood, or separated from that artery which it should support and assist in its adhesion. That an artery in the moment of being wounded may be made to reunite, I hold to be an absolute fact, not because it is proved by the authority of those who have prevented aneurisms by a skilful compress; for in such cases, the aneurism being prevented,

* For the purpose of compressing a wounded artery, the older surgeons usually put into the folds of their first compress, a piece of money, a split bean with the convex side towards the artery, a peach stone, the half of a walnut shell, &c.

we still are left in doubt whether the artery was actually wounded ! but the aneurismal varix ascertains the fact.

The Aneurismal Varix is a disease produced after bleeding with the lancet, by the close union of the wound of the artery with the wound of the vein, and the blood of the vein rushing into the artery through this side passage distends it. I would trace, in the following order, the several forms which a wounded artery assumes.—First, It generally happens, after any accident of this kind, that the compression which the surgeon makes, while it prevents the outward bleeding, is not sufficient entirely to subdue the action of the artery, which bleeds inwardly ! the blood is then poured out under the fascia ! the holes or lancet wounds in both sides of the vein, (through which the artery was struck), heal ! the blood is extravasated under the fascia, and the fascia, by its great strength and tension, resists the effusion, so that it takes place very slowly : It is thus, that, in about a month or six weeks, the common aneurism of the arm is formed, having for its external coat the thick fascia of the biceps muscle.

Secondly, It sometimes happens, that the pressure made by the surgeon at the time of the accident, is so steady as to produce an adhesion of the wounded lips of the artery with the wound of the fascia ; then the disease does not appear in its proper form ; there is no resistance from the fascia ; the artery does not eject its blood slowly into the cellular substance under the fascia, but drives it freely under the common cellular substance of the skin ; the regular form of the disease, the circumscribed tumour, is wanting, and the whole arm from the shoulder to the wrist is black with extravasated blood as if mortified.

Thirdly, It often happens, that the pressure is still more correct, steady, and well supported, and the vein on the outside of the fascia is kept in close contact with the fascia ; while the wounded artery within the fascia is kept in close contact with its inner surface ! the artery unites with the inner surface of the fascia, the vein unites with its external surface ; and a lateral communication being thus established betwixt the artery and vein, the vein is dilated by the force of the artery into a varix ; which, from the nature of its connection with the artery, is named ANEURISMAL VARIX. In this disease the blood passes so easily into the vein, that little blood goes downwards along the artery ; the arm below is impoverished of blood, and is greatly weakened ; the dilatation of the vein increases almost to bursting ; and as the vein and artery, though they run parallel, are not in contact with each other, but are separated by the sheet of tendon

named the Fascia, the communication betwixt the vein and artery comes to be of considerable length ! by emptying the dilated vein, and pinching with your fingers and thumb, you can distinctly feel the communication betwixt them.

Fourthly, The artery where it lies within the fascia is surrounded with a set of small concomitant veins, which, from their encircling the artery, are named *Venæ Comites*, or *Satellites* ; these also are sometimes struck with the lancet ; and, by continued pressure, the artery ! the internal vein ! the fascia ! and the external vein ! are all massed together with a considerable degree of confusion, and thickening of parts. But however confused the other appearances may be in such a case, this circumstance will distinctly mark the nature of the disease ; that in performing the operation (as there are two veins and one artery united by adhesion,) the surgeon will find two successive sacs of blood, one under the other, with a small orifice of communication betwixt them. Perhaps the anomalous case related by Mr. Park of Liverpool was of this nature ?

The young man, whose case Mr. Park describes, had been coarsely bled, was sensible at the time of being struck too deep in the arm, and felt more than ordinary pain. He presented himself three times successively at the Liverpool Infirmary. Even at the first this was marked as an anomalous disease ; for there was a complication, as if of common aneurism with aneurismal varix. There lay immediately over the wounded artery, and receiving its pulsation, a small hard circumscribed tumor, no bigger than a walnut ; and there accompanied this smaller tumor, a considerable aneurismal dilatation of the Basilic vein. He called a second time at the Hospital, and still the aneurismal tumor over the artery held itself distinct from the varicose dilatation of the vein. It was about a year after the disease began, that, having used too great freedoms with his arm, he was brought into the Infirmary a third time with the arm greatly swelled, inflamed, and partly suppurated ; and the tumor having burst during the night following his admission, there was a necessity for performing an operation, which, considering the anomalies of the case, the late hour at which the operation was performed, and that alarming loss of blood which made it necessary, must have been very unsatisfactory to Mr. Park. But he delivers this interesting case with singular modesty ; and though, in making this operation known to the profession, he has perhaps done no more than his duty, yet he has done it in such a manner as to deserve our gratitude. It was remarked by Mr. Park, that in the time of the operation, after opening the first sac, he saw an orifice which seemed to him

to be the orifice of the artery; but he found, upon introducing the probe, that it could not pass upwards nor downwards farther than half an inch. Upon opening this second sac, he found at the back of it a second opening, a small, round, circumscribed orifice, which led into the artery. The artery thus discovered was tied accordingly, and the operation finished.

In this case one of two things must have happened! The artery, the Vena Comes, the fascia, and the outward vein, must have all united together, being massed and thickened by inflammation; the ready communication of the Vena Comes with the outward vein, may have saved the Vena Comes from dilatation; and the circumstance of the fascia covering the dilated part of the internal vein, (and adhering to it), may have given it peculiar firmness, and may account for the internal tumor being so small, (it was no bigger than a walnut); and farther, the frequent valves in this Vena Comes, or internal vein, may account for the limited dilatation of it, and for the probe not passing easily upwards or downwards. Or, on the other hand, the artery may have begun to form a proper aneurism among the cellular substance; the passage betwixt the fascia and the vein may have continued open; the blood may have made its way from the sac of this incipient aneurism into the vein; and, if so, the blood being thus conveyed away through the vein, the force would be taken off from the proper aneurismal sac, the cellular substance would be condensed into the form of a regular bag, that bag would be saved from further distention by its free communication with the vein, and the perpetual circulation of fresh blood, through it, would prevent the formation of clots, and would also prevent the tumor assuming the proper form of aneurism.

Mr. Park's Anomalous Aneurism



1. Branches of the Median Vein
2. Branches of the Basilic Vein
3. The Brachial Artery
4. The Vena Comes surrounding the Artery

5. Union of the Vena comes with the Trunk of the Basilic Vein
6. The wounded artery
7. Dilatation of the Vena Comes
8. Dilatation of the Med. Cephal Vein

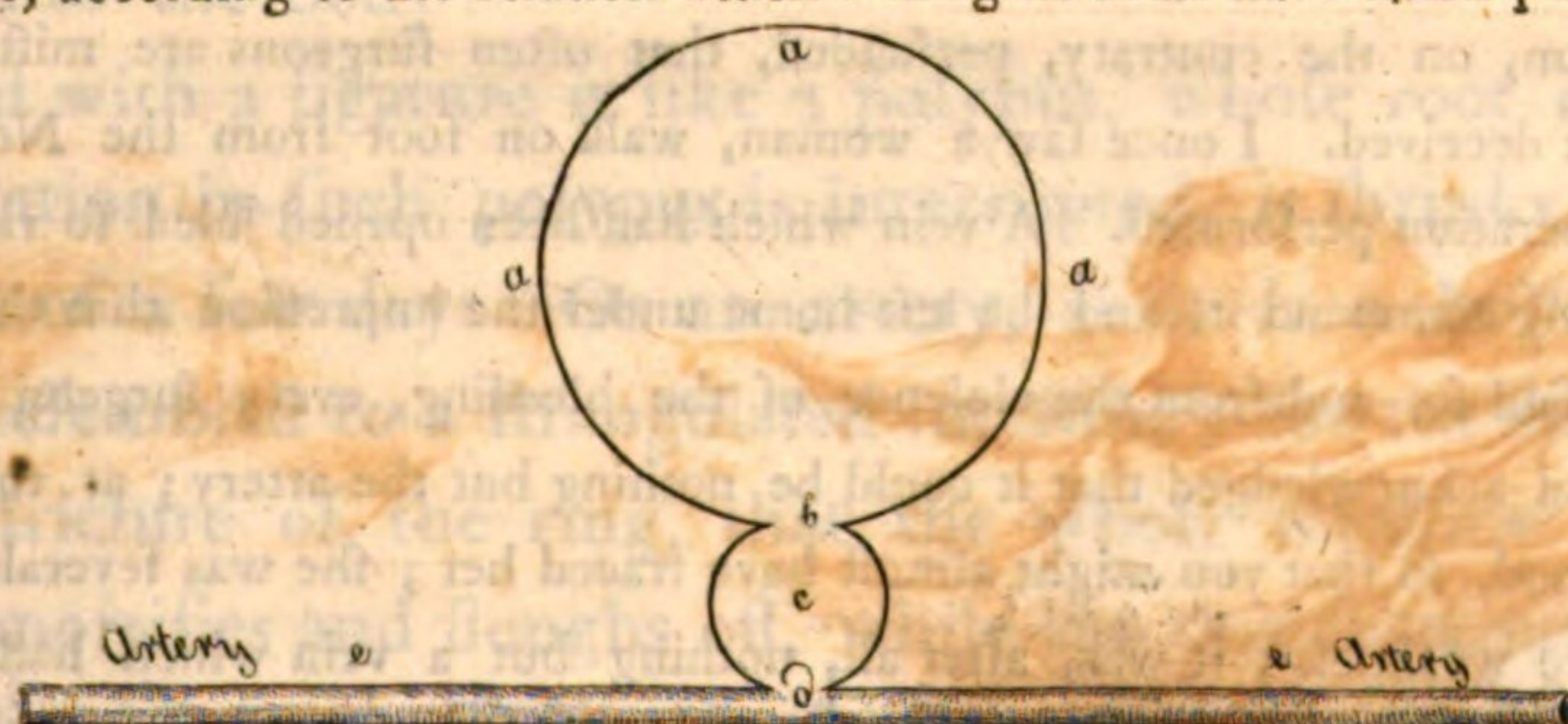
J. Bell sculp.

Now, these various adhesions sufficiently prove to me, that an artery may be healed; for if an artery can thus be made to adhere to the Fascia and vein, so as to form an aneurismal varix, it may, by a firmer and steadier degree of compression, have its wounded lips reunited; and this seems to be the more probable, when we consider how these lips of the wounded artery are imbedded in cellular substance, actually wounded along with the artery, and ready at all times to swell and close the wound.

Thus, though I do not believe that an aneurism, perfectly formed ever has been cured otherwise than by a total obliteration of that artery which produced it; * yet am I well satisfied, that after a recent wound with the lancet the generation of aneurism has been often prevented. The celebrated Brambilla recommends, as the surest of all compresses for immediately healing a wounded artery and preventing aneurism, the pellet of chewed paper, supported with graduated compresses and a firm bandage. The cure which Brambilla performs thus, is not like those of Bourdelot and Morrand, an obliteration of the canal of an artery, whose lips are become too callous to be reunited! but the reunion of an artery recently wounded, the wound of the artery itself fresh and raw, and the surrounding cellular substance also wounded and inflamed; not an obliteration by compression, gradually increased for the space of a year, but an

* In the following Chapter, some further views of this subject, as they relate to Natural Aneurism, will be explained.

Mr. Park gives the following plan of his own operation, and from it I have ventured to make the conjecture which I have delivered above. A section of those cysts, says Mr. Park, would exhibit some such appearance as this, (a a) The first or outer cyst; (b) The orifice leading into the second or deeper cyst; (c) at the bottom of which was seen the orifice (d) leading into marked (e e). I have made my plan, at the foot of last page, according to the relation which I imagine must have taken place among the wounded vessels.



N.B. the word Artery marked e. e. is omitted in the Text.

immediate reunion, procured by the neat apposition and steady support of the wounded parts, continued for no longer than eight days *.

It is an anecdote in surgery, not unworthy of being related, That this wound of the artery is as frequent in Germany now as it was in France in those days when Dionis practised, and when the surgeons were, by law, obliged to pension those whose arms they had injured in bleeding. "In Germany, says a great surgical writer, the phlegm has acquired a great reputation," but the harm it has done, while it has been acquiring reputation, is incalculable; for Brambilla says, "I have frequently been present when the young surgeon, having struck a vein with the Fleam, (*Vena Phlebotomo elastico incisa*), has been unable to stop the bleeding; the young man being himself ignorant, says Brambilla, of having wounded the artery, I have, to prevent alarm, tied up the arm myself. Upon leaving the house, I have asked the young man whether he was sensible of having wounded the artery? when suddenly, recollecting the decisive signs of a wounded artery, he has nearly fainted at the thought †."

Brambilla adds, that innumerable accidents of this kind prove that wounds of the artery, especially in bleeding, may be easily healed ‡.

* *Vulnere hac ratione deligato, membrum, per octo decemve dies, flexum quietumque tenendum est, quibus preterlapsis quod si fascia solvatur, arteriæ vulnus plerumque glutinatum apprehenditur.* Brambilla, page 93.

† *Contigit aliquando, ut me præsentem juvenis chirurgus, vena phlebotomo elastico incisa, sanguine cohibendo haud sufficeret, ut pote nescius arteriam læsum esse. Quin ægra rationem inspiceret aut aliquid auspicaretur, ipsemet ego deligationem modo superius exposito administravi, totamque curam perfeci. Cum vero egrediremur interrogavi juvenem illum chirurgum, nonne arteriæ vulnus inflictum esse animadverterit? at ille phaenomenorum, sub operatione conspicuorum, nunc subito reminiscens, tanto terrore percellabatur, ut parum abfuerit, quin animo, defecisset."* Page 92.

‡ I am far from thinking that every case thus bandaged by the surgeon, and thus cured, has been a wounded artery. I am, on the contrary, persuaded, that often surgeons are mistaken, though, surely, Brambilla could not be deceived. I once saw a woman, walk on foot from the North of Scotland, 300 miles, to have some operation performed. A vein which had been opened bled so violently, that even the tourniquet could scarcely command it, and she left home under the impression that the artery was wounded; her own surgeon said so, and from the violence of the bleeding, every surgeon who had seen her in her way up to town had acknowledged that it could be nothing but the artery; at the end of every day's journey she had lost blood, so that you might almost have traced her; she was several times obliged to stop a day or two from mere weakness; it was, after all, nothing but a vein which had ulcerated and would not heal; but it was easily obliterated by a firm pellet of chewed paper kept very firm for a few days.

OF THE CONDITION OF AN ARTERY WHEN TIED WITH LIGATURES.

These are my notions of the condition of a wounded artery; and we shall proceed next to investigate the state of the artery when actually tied with a ligature. This, far from being an idle speculation, is, I trust, an inquiry which will lead to very important conclusions; for we naturally inquire, first, How the artery, (when tied as in the operation of aneurism), is affected by the two ligatures which are put round it? secondly, How the open artery of a stump is affected by the single ligature with which it is tied? and this leads directly to a very interesting inquiry, viz. How the accidental bursting of arteries is to be prevented, and from what causes secondary hæmorrhages arise?

An artery is part of the living system; it is, indeed, neither sensible, so as to convey, when injured, the sensation of pain, nor is it irritable, so as to contract like a muscle upon the application of ordinary stimuli from without; yet is it not the less a part of the living system, apt, when injured, to enter into a proportioned reaction. An artery has its vasa vasorum, its arteries, veins, and lymphatics, for the growth, support, and nourishment of its own coats. Its circulation and nourishment is according to the common laws of the system; and having this apparatus of active vessels, it is connected with the surrounding parts by the common cellular substance, by lesser arteries and veins, and the division of that cellular substance, or of the artery itself, is as much a wound, as an incision in the skin is! By what laws then should we calculate the effect of ligatures on arteries? or by what analogies should we explain them, but by similar operations upon other parts of the body?

An artery tied with a ligature is like a polypus, whose root is tied by a ligature; the circulation in such polypus is interrupted, it shrinks, dies, and drops off in the course of a few days: Or an artery, as it is a hollow tube, may be more correctly resembled to a strangulated intestine; for the intestine is so compressed by the stricture of the ring, that the whole intestine is inflamed, the middle portion mortifies and sloughs off, while the two extremities where the intestine is immediately compressed by the stricture, inflame, and adhere to the ring; and the hollow part of the intestinal tube would also be obliterated, but for the perpetual passage of fæces and flatus, and because there is not, as in the arterial

system, any lateral passage by which the circulation of fæces through the rest of the intestinal canal could go on.

In performing the operation for aneurism of the arm, we usually apply two ligatures upon the artery, which include betwixt them about two inches of its length; one ligature is applied above the point where the artery is wounded, and one below; and both these ligatures come easily away on the fourth day, without our needing to cut the ring of the ligatures where they encircle the artery. How is it that these ligatures come so easily away? How do they come away thus without the loop or ring of either of the ligatures being cut open? What becomes of the intercepted portion of the artery? What is the condition of these two points of the artery which were embraced by the ligatures? Surely it happens here, as in all other cases in which we apply a ligature, that the part affected by that ligature is necrosed, mortified, cut off from the system. In this operation of tying an aneurismal artery, first, the pulse ceases the moment the ligatures are drawn, a sign surely that the sides of the artery are fairly compressed against one another; secondly, The space of the artery (two inches perhaps in length) is so fairly intercepted by the two ligatures, that not only does the blood cease to pass along the canal of the artery, but the circulation in the vasa vasorum, in the nourishing vessels of the artery itself, ceases!—the intercepted piece is killed just as a polypus is by a ligature!—The death of this intercepted piece prevents its supporting and continuing its connection with the surrounding cellular substance, whence it happens, that of the arterial canal all that is intercepted between the ligatures dies; the cellular substance surrounding that portion of the artery suppurates, and the intercepted portion of the artery is as fairly cut out, as if it had been dissected away with the knife!—and as a polypus, when tied in a noose, fades on the second, and drops away on the third or fourth day, in like manner an artery, after being thus tied, decays, mixes with the purulent matter of the wound, and the ligatures become slack on the second, and may be drawn away on the fourth or fifth day. The two ends of the artery are meanwhile obliterated by adhesion of their opposite surfaces, so that before the ligatures slacken, this adhesion is strong enough to resist the impulse of the blood, and indeed if it were not for this part of the process, hæmorrhagy must always ensue whenever the ligatures were withdrawn. Mr. Petit, in support of his own doctrine, ventures to say, “that the ligature is insecure, because, if the ligature falls off before the clots become firm, the artery will bleed.” But this premature falling off of the ligature,

which he apprehended cannot happen ! the ligature will not even slacken before it have effectually done its business ; or, in other words, one part of the artery will never be mortified and separated until the part above and below have been obliterated by adhesion, in consequence of the immediate pressure of the ligatures.

This process then may be explained in few words *. The ligatures applied round an artery operate by making the several points of the arterial canal pass through the several stages of inflammation, from adhesion in one point, to gangrene in another. The space included betwixt the ligatures falls into gangrene, the space immediately under the stricture of each ligature adheres ; this adhesion prevents the gangrene or the inflammation passing along the higher parts of the arterial canal ; but the inflammation affects the arterial tube a little way upwards and downwards, so as to thicken its walls and contract its cavity, whence the canal of the artery is obliterated a little way beyond the exact place where it is tied. All this is proved by the reports of those very surgeons who continued theorizing about the contraction, and straitening of the artery, after they were sensible that the internal surfaces of the artery adhered †.

Pathology of an Artery tied with Ligatures



J Bell sculp

† We find the following account of this process in Kirkland, p. 5. "An aneurism of the arm, being in great danger of bursting, obliged me to perform the operation : The impulse of the blood against the ligature, at the time of the operation, was very great ; and as a part of the artery (whose diameter was considerably enlarged) was exposed, its pulsations were visible ; but upon removing the dressings the third day afterwards, the pulsation could neither be seen, nor felt nearer to the ligature than an inch and a half ; whence I was led to conclude, that the artery had *collapsed* and *gradually closed* itself up, to the nearest lateral branches."

I have observed after I had performed the operation for aneurism, that on the third day, no pulse was to be felt at all in the wound ; but I never considered this as in the least wonderful, seeing how very probable it is, that by that time, the ligature must have cut across the artery, the artery must have shrunk, and its canal must be obliterated considerably beyond the place to which it has shrunk. But there is also another

That arteries never bleed from the flat surface of an amputated stump, is still a more decisive proof of this doctrine; we pull out those arteries with the tenaculum or forceps, tie them with a small thread, and pull that thread away by the third or fourth day; no one will suppose that when the ligature is drawn away, such artery is prevented from bleeding by a clot stopping the mouth of the artery, as Mr. Petit imagined; nor that the canal of the artery is compressed by the inflammation and thickening of the surrounding cellular substance, as alleged by Mr. Pouteau; for we draw out the artery and tie it quite clear of any cellular substance, or muscle, or adjacent nerve. The artery when tied thus, can be obliterated only by the adhesion of its internal surfaces! the part directly under the compression of the ligature unites by adhesion; the part below the ligature is destroyed like a polypus, fades and dies; and it is the fading of the lower part thus mortified, that allows the noose of the ligature to slip off on the third or fourth day *.

One thing particular that Mr. Kirkland and Mr. White insinuate upon all occasions, that the artery is obliterated just up to the first inosculating branch, and always up to it. Mr. White says,—“In the arm I have by me, on which the operation for aneurism had been performed, it is plain to a demonstration by the injection, that the artery was closed, both above and below the ligature, to the next lateral branch.”

His preparation was at that time, the only one in existence; “but I have also by me” the preparation from the arm of a man who had formerly had the operation for aneurism performed upon him, and it is so particularly like Mr. White’s, that were I to give a drawing of it, it would be thought to be a mere plagiarism; but in this very curious circumstance it differs, that the injection, though coarsely done, and in great hurry, has passed the great inosculature (for in my preparation, there is but one great inosculature to support the limb), a full inch and a half, terminating in a blind sac.

* A very curious proof of the truth of that doctrine which I have laid down above, concerning the obliteration, destruction, and sloughing of that part of the artery which is intercepted betwixt the ligatures, is to be found in the following fact:

The celebrated Guattani having operated upon a popliteal aneurism, gives this account of the destruction of the sac itself. It was a Natural Aneurism; the artery was dilated into a fair circumscribed tumor about the size of a goose’s egg; he tied the artery with two ligatures, one above and one below this tumor; he then opened the whole cavity of the tumor itself; both ligatures came away on the eleventh and twelfth days, and with the last ligature the sac itself came away. When the sac sloughed off it left the hollow fore as large as the sac, and the sides swelling around the basin or hollow, formed a cavity much deeper than the sac which had sloughed off from it; in short, the ulcer was so deep and large, that no one could behold it without horror. The unequivocal terms in which Guattani explains the sloughing of this great sac, deserves to be recorded: “*Hac methodo, feliciter perveni ad undecimum diem, quo inferius vincula suo sponte cecidit, eademque ultra proferens die duodecima etiam superiori vinculo una cum sacco putrefacto elebante, ulcus optime absterfum emundatumque reeditum est. Illud autem decem transversa digitos longum, fere*

The pathology of a tied artery is thus reduced to common principles; the obliteration and adhesion of a wounded artery, is truly compared with the re-union of any other wound; and one subject of inquiry alone remains, the most important perhaps in surgery, "What are the causes which prevent the adhesion and obliteration of an artery, and produce ulceration in its coats? for the causes which thus produce ulceration and prevent adhesion of the artery, occasion those secondary hæmorrhages of which so many patients die! We never leave our patient bleeding, but it often happens, that in the course of a few days after aneurism or amputation, the blood bursts out suddenly and our patient bleeds to death! Direct hæmorrhagy from a recent wound is easily suppressed, for we see the artery and can tie it; but this secondary hæmorrhagy is peculiarly dangerous, it comes upon us when we are least aware, the parts are ulcerated, or mortified, and the bleeding artery is no longer to be found.

OF THE CAUSES OF SECONDARY HÆMORRAGY; AND, FIRST, OF BURSTING OF THE ARTERY

FROM THE DISEASED STATE OF ITS COATS.

The bursting of an artery after it seems securely tied, arises sometimes from the unfavourable state of the artery, and from its being incapable of adhesion, but much more frequently, does it happen from that process which should terminate in adhesion of the artery, proceeding to inflammation, and ulceration of the arterial coats. The diseases of the arterial system have not been even slightly investigated! There are few people who have passed their grand climacteric without having the condition of the whole arterial system very remarkably changed. The extreme arteries, the active arteries, in all parts of the system, are less affected, they preserve their natural pliancy; but the great arteries which serve but to conduct the blood, and whose contraction is less important to the existence of life, are remarkably affected. We are sensible towards the decline of life, of changes in the great arterial trunks, plainly unfavourable to our operation. *omnem a decidente sacco relictam, conservabat, et ob superadditam laborum tumefactionem majori etiam donatum erat profunditate quam illa fuerat quæ cum aneurismaticum coarcebat. Uno verbo ulcus, hoc ejusmodi erat ut ad illius aspectum omnes horrore perfunderentur.*"

tions; the cellular substance which joins the coats of the arteries is diseased; the whole tube is but ill disposed to pass through those changes which are familiar to the other soft parts. They do not adhere, inflame, thicken, and obliterate, as sound parts do! In dissecting an aged subject, we always find the arteries less pliant, sometimes they are contracted, sometimes enlarged, they become white, and their coats thickened and less connected with each other, separate like the coats of an onion into ten or twelve, or into innumerable lamellæ; they are at the same time brittle, and fragile, and have a crisped feel; they are sometimes ossified; they break or crack when we attempt to bend them; and the drawing of a ligature round such an artery tears it from want of pliancy! our anatomical injections are successful only in very young subjects; while in older subjects the arteries burst because they have lost their strength; or tear under the necessary ligatures because they have lost their pliancy! the anatomist knows by the first touch of the femoral artery, for example, whether his subject will bear to be injected! and the surgeon in like manner often foresees by the first touch of his finger, those burstings of the artery and secondary hæmorrhages of which so many have died.

Thus it often happens, that the artery, too hard to bear a ligature, breaks and tears across in the very moment of drawing the ligature; the artery must no doubt have been in this condition, which gave the celebrated Petit so much trouble and anxiety in the case of Mr. Seneuze the bookseller. Mr. Petit having amputated this gentleman's thigh, found that the femoral artery was nothing affected, neither by the tourniquet nor by the ligature; and he was obliged in the end to suppress the hæmorrhagy by compresses piled upon the face of the stump, and braced down with very firm rollers. It must also have been an artery of this kind, by the bursting of which Mr. Acrell had almost lost his patient; for the artery did not stand the ligature one moment, but in a manner burst under his fingers! The case is as follows:

“ A foldier, of a scorbutic habit, extremely weak and convalescent, was stabbed unfortunately with a pointed knife in the femoral artery, about seven inches under Paupart's ligament; and the wound bled so furiously that he fainted: A physician, who was called, bound it up so effectually with compress and bandage, that he stopped the bleeding for twelve days; but the blood burst out again on the thirteenth day; notwithstanding which, the outward wound healed, the aneurismal tumor was distinctly formed, and by the twentieth day it beat very strongly, threat-

ening rupture. Acrell thinking the aneurism too large to be cured by compression, proposed to tie the artery; he opened the tumor; scooped, and washed out the very black and foetid blood, and exposed the artery, which he found dilated for about four inches into a large sac of about three quarters of an inch in diameter. He then tied the artery with one ligature above, but behold while he was drawing the lower ligature, the artery suddenly burst above the upper ligature, and threw out its blood with such force, that in less than a minute the man had lost fully four pounds of blood *." This artery tore under the pressure of the ligature; the tourniquet could not command the hæmorrhagy; the ligature itself was ineffectual. In these distressing circumstances, Acrell at last suppressed the hæmorrhagy by sponges and compression! with his sponges and compresses, he "filled up the whole cavity of the aneurism; and to ensure a proper compression, he made a sheath for the thigh of white iron, with a globular compress upon its internal surface, adapted to the place of the wounded artery." Thus he accomplished the cure, and the case is a singular example of the artery in that very state which I have described breaking under the ligature! giving way in the very moment of the operation.

* Scorbuto atque febre tertiana protracta quam maxime debilitato militi cuidam permoleste accidit, ut cultro incaute, septem pollicum a ligamento Fallopiiano distantia, vulnus femori suo interno infligens, arteriam ipsam simul aperiret, quo spumeus torrens initio tam vehementer profudit, ut animo fere linqueretur læsus: proprio vero Marte demum hac vice substitit. Cautè tamen Medicus vocatus, ad præcludendum sanguinis erumpentis exitum, spleniolis et fasciis membrum constrinxit, eoque ad duodecimum usque diem novos hæmorrhagiæ insultus impedire potuit. Cum vero jam tertio aut quinto quoque die vulnusculum iterum sanguinem funderet, et vigesimo die tumor aneurismaticus cum pulsu distinctissimo exurgeret, isque, octo præterlapsis diebus, rupturam minaretur, operationi æger sese subiecit, quam ill. ACREL ob magnitudinem et suffusionem, non compressione, sed ligatura perfecit. Repurgato nempe, post incisionem primam vulnere a concreto jamque valde foetente sanguine, et denudata, donec injiciendæ ligaturæ locus in conspectum veniret arteria, quam farcininis instar ad 8 linearum diametrum et manus transversæ longitudinem dilatatam invenit, primam superiorem ligaturam applicavit. Cum vero inferiorem contraheret, ex inopinato arteria supra superiorem ligaturam disrupta, unde tanta vehementia vitalis latex prorupit, ut intra minuti spatium quatuor ad minimum libræ effluerint. "His in horrendis angustiis, cum nec nova ligatura, nec torcularis contractione hæmorrhagia sisti posset, in trunco ipso, dum ex inguine prolabitur, pollicibus firmiter admotis, compressionem instituere placuit, quo effluxus substitit." Atque tum, spongiæ frustulis ad arteriam disruptam directis, compressionem tentare coactus fuit. Eorumque effectus, toto cavo his ipsis repleto, jam exoptatissimus fuit. Sed vim comprimentem adaugere meditans, laminam ferream, formæ femoris adaptatam et globo in concavam faciem ferruminato instructam, femori ita applicavit, ut globus in arteriam disruptam vim suam exerceret. Atque sic, nec nova hæmorrhagia, nec ullum aliud incommodum, a ligata et compressa arteria metuendum, sub reliqua cura spem perfectæ curationis conceptam sufflamavit.

But besides being thus hard, and apt to break under a ligature, such artery is also callous, so as to be unapt to adhere; and thick in its walls, so that it is not easily compressed; and very often this unfavourable condition of the artery is rendered more dangerous by the awkward manner in which the ligature is applied. Thus the femoral artery having its walls thickened, its cellular substance unbound, its coats not closely connected, but rather apt to separate, the internal surfaces can never be neatly applied to each other, for in consequence of the great caliber of the artery, and of its cylindrical form, of the thickness of its coats, and of the want of pliancy of the whole tube! in place of flattening, when the surgeon applies his ligature, it is puckered and pursed up. Besides, I daily observe operators using ligatures for the femoral artery, as thick as common tapes, the loops of which, when twisted and drawn in the form of a surgeon's knot, are actually larger than the arteries round which they are applied; so large indeed, that it is impossible to draw them close.

Mr. Duchamps, a French author, mentions one operation for aneurism, in which the surgeon actually could not draw his great ligature tight enough to suppress the bleeding; and from this cause alone, he was forced to cut off the limb; an artery thus diseased is apt to tear under the ligature; or if it be strong enough to bear the ligature, by being callous, it fails to unite; the interruption which the ligature gives to the blood is mechanical only! no adhesion ensues to continue the resistance! and of course when the ligature falls off, the artery opens, and the hæmorrhagy returns.

OF BURSTING OF THE ARTERY FROM ULCERATION OF ITS COATS.

Yet it is not to this unhealthy condition of an artery that I ascribe the death of those who have perished from secondary hæmorrhagy. The indisposition of the arteries never can explain the difference of danger in the two operations of aneurism and amputation.—In amputation of the thigh we tie the great femoral artery; we tie also the profunda, and its muscular branches; we perform amputation daily, and we tie many great arteries in each amputation; each ligature is seen moved and raised up from the face of the stump at every pulse of the artery; the stump remains open. These arteries continue for weeks to bear the whole force of the circulation, unsupported, yet they never give way.

But, in the operation for aneurism of the thigh, the difference of security is very great ; for this operation is, on the other hand, so full of uncertainty and danger, that hardly any case can be mentioned in which the surgeons have not been alarmed, and the patient in great danger, from secondary hæmorrhages : It is an operation never performed but by surgeons of the first eminence ; and yet more, perhaps, have died than have survived it. Hunter himself has lost his patients ; those whom he did save were endangered by secondary hæmorrhages : and concerning the celebrated Mr. Pott, (who, from the ill success of one operation, was forced to amputate the thigh), it has been insinuated, that he missed the artery altogether : “ The depth of the incision made it impossible for any but the operator himself, and those who were immediately assisting him, to see what was included in the ligature, *and at the time* the popliteal artery was *supposed* to be secured by it.” From this foul accusation I shall find an opportunity of defending the memory of Mr. Pott. I mean only to explain to you at present, that even the greatest surgeons have not been free from reproach ; and, indeed, the imputation is fairly established, not against particular surgeons, but against the science itself, “ That the rules of surgery in respect to aneurisms are imperfect.” It behoves us then to inquire, What the difference is betwixt tying the femoral artery in aneurism, an operation so full of difficulty and danger ; and tying the same artery in amputation, an operation which is so perfectly safe, that the death of a patient by hæmorrhagy would be a flagrant disgrace ?”

SECONDARY HÆMORRHAGY arises from ULCERATION of the ARTERY more frequently than from any other cause ! In amputation, such ulceration happens only when the ligatures, having been firmly tied round the nerves, are prevented from slipping off, or when the whole surface of the stump falls into disease, and is eroded ; but in aneurism it is peculiarly frequent, from the manner in which a great length of the artery is insulated and detached from the surrounding parts. Surgeons have been used to sew bowels, as if they had no comprehension of succeeding otherwise than by the mere firmness of the suture ! as if nature had nothing to do in the cure ! In like manner, in tying arteries, they pull their ligatures with a firmness that defeats its purpose, here also they seem to depend entirely upon the mere mechanical force, as if there were no process of nature to follow this mechanical stricture, nor to support the artery when the ligature is withdrawn.

If the surgeon, forgetting how slight a force suffices for suppressing the pulse

of a naked artery, and for laying its sides in contact, pulls his ligature with all the firmness which the artery can bear, although the artery be not immediately cut across, its coats may be twisted and weakened ; or, though not even weakened, they may be so violently compressed that not only the portion of the tube intercepted between the two ligatures, but the part immediately under each ligature will fall directly into gangrene in place of adhering, so that, on the third day, when the ligature is withdrawn, it may bring along with it the end of the artery.

If the surgeon, in place of dissecting the artery fairly, strikes his needle coarsely under it, and includes much of the muscular substance, or other soft parts, the pressure never is sufficient, it is even, at the first, insufficient from the softness and yielding of the parts, there is little pressure, there is no adhesion of the artery under the ligatures, there is no amputation of the intercepted part of it ! the cellular substance and muscular flesh fade and give way on the third or fourth day : But the artery itself is still entire, and the blood, by this slackening of the ligatures, passes along the canal of the artery, and out at the wounded point ; and as the structure of the artery is but little affected by so slack a ligature, the artery continues entire, the ligature keeps its place round the artery, and, though it does not compress the artery, it irritates it, and is never disengaged till the artery falls into ulceration and bursts.

If the surgeon be still more awkward in his operations, he will not merely strike his needle through the flesh, but will take the nerve into the loop of his ligature ! for every great artery has the great nerve of the limb accompanying it, the brachial artery has the great radial nerve, the femoral artery has the great anterior crural nerve, the great artery, nerve, and internal veins of each limb, lie in a peculiar sheath, and, in order to tie the artery apart from the vein and nerve, it is necessary not only to cut up the general fascia of the arm or thigh, but to dissect this peculiar sheath of cellular substance. Now, authors have always talked slightly of tying the nerve, as if the tying it related only to the nerve itself ! No ! it relates to the security of the artery ! an artery, tied with a ligature, is destroyed in a few days, but a nerve tied with a ligature is hardly affected by it : The nerves are peculiarly strong, their coats hard and firm, a ligature tied round a nerve and artery together, as it cannot destroy the nerve, keeps its hold upon the artery, till, by the irritation of the ligature, and other obvious causes, it ulcerates and bursts ; or if this can be prevented, it is only by cut-

ting the ligature timeously away, which cannot be done without a degree of difficulty and danger.

But there are still other causes of the ulceration of arteries. If the surgeon, anxious to ensure the obliteration of the artery, resolves to lay a considerable length of the sides of it in contact, what does he do but insulate the artery, tear it up from its bed among the cellular substance, separate it from all those vascular connections which kept it alive ! he exposes it to almost inevitable ulceration ? This has been practised upon the femoral artery in a great variety of ways, all of them ingenious, but all in direct opposition to the principles of surgery. Thus we have an operation of Mr. Cline of St. Thomas's Hospital, very confusedly described, where the artery must have been completely separated from all those connections by which it is nourished and supported in its natural state. The case is related by Mr. Home*, who is generous enough to acknowledge that Mr. Cline had no share in drawing up the report. He begins thus : " The particulars of the case I have not received from Mr. Cline, but have taken them from my own observation, and the information of gentlemen who attended the patient, and were present at the examination after death. The patient was a sailor, who came into St. Thomas's Hospital, to undergo the operation for the popliteal aneurism. Mr. Cline made a longitudinal incision on the anterior part of the thigh ; and, having laid bare the artery, passed, by means of a tin instrument, a double tape, about one inch broad, behind the artery, the two pieces of tape lying one over the other ; the piece of tin, which conducted the tape, was cut off, and a cork, nearly an inch long, was laid upon the artery, and confined to its situation by means of the upper tape, producing in this way a sufficient pressure upon the vessel included between the ligature and cork, to stop the circulation, and consequently the pulsation of the tumor in the ham ; the other portion of the tape was left loose. The intention of securing the artery in this way, was to compress the sides of the vessel together, *and produce an union without ulceration !!!*"

" The patient went on very well, and the ninth day the tapes was removed, and every thing seemed to be going on very favourably, when the patient was attacked by a fever, (which was supposed to be from another patient in the same ward), of which he died. Upon examining the state of the limb after death, it was found that ulceration had taken place through the whole extent of the arte-

* The Mr. Home that writes on the Urethra.

ry included in the tape; and sinuses were formed both upwards and downwards, in the course of the thigh, to some distance."

Let us observe, for a moment, what must have been the condition of this artery? The blood was scooped out from around it, the cellular substance destroyed, and indeed almost gangrenous from the injection of the blood into it: The artery being thus entirely insulated, a cork of an inch long was laid along it, a tape of an inch broad was tied round it, and thus the artery was included betwixt the tape and the cork, while another doubling of the tape lay under the artery, a little higher up, to be used as a second ligature, when occasion might require. Thus some inches of the artery were insulated; the artery itself lay across the great sac of the aneurism, like a string across a bow; this operation was undertaken with notions of the cure, which never could be fulfilled; it was thought possible to compress the artery so curiously, and with such a nicely regulated pressure, "as to prevent the blood passing along the artery, but without causing ulceration," or, in other terms, without cutting the artery across! But the impossibility of succeeding thus, is plain, from the radical proposition which I have just laid down, "it is impossible to intercept a piece of the arterial tube so betwixt two ligatures as to cut it off, without causing the two ends of the artery to adhere at the points where the ligature presses them together;" and the converse of the proposition is equally true; "that it is impossible to check the blood in an artery, to compress the tube, to lay its sides so closely together as to produce adhesion without cutting off the intermediate piece." The impossibility of succeeding in such an intention is sufficiently proved by reasoning, but the danger of the attempt is demonstrated by the issue of this case, which is just what might have been foretold: "Ulceration had taken place through the whole extent of the artery included in the tape;" sinuses also had extended along the bed of the artery; had this patient survived the fever which attacked him, the artery must have burst out, he must have died of secondary hæmorrhagy.

It is this ulcerated state of the artery that makes it necessary to apply successive ligatures! and it is this diseased condition of the artery, this progressive ulceration, that makes those successive ligatures give way. In operations upon the femoral artery, it is first of all insulated by the great extension of the sac in which it lies; it is in danger of being eroded by the very foetid matter which always fills a great aneurismal sac, distended with corrupted blood and sanies; and it is sure to ulcerate from the coarse and complicated apparatus with which it is tied. It is usual-

ly laid out along a cork, or tied down along a piece of bent-leather, which was used indeed by Ruisch in one of the first operations of the kind that ever was performed *. I find Mr. Duschamps using a small machine made of silver, consisting of a horizontal plate, which lies upon the artery; and in this plate there are two flits through which the tape passes, which furrounds the artery; from the middle of this flat plate, stands up a shaft of some inches in length, over which the ends of the tape or ligature are tied. Concerning these machines, I feel that I do no more than justice, when I acknowledge the ingenuity of the inventions; but to you I should do great injustice, if I did not protest against them as altogether inconsistent with the principles of surgery.

These contrivances for insulating the artery are sure to cause that ulceration, which too many natural causes conspire to produce. The laying a piece of cork or bent-leather along the artery, the using such an instrument as this of Mr. Duschamps, the laying relays of ligatures above and below the place where the proper ligatures are applied, the tying a considerable length of the arterial canal with four thick coarse ligatures in place of two! the stripping a considerable extent of the artery of its cellular substance! the surrounding the artery with pellets of scraped lint, and keeping it extended across the foul and gangrenous sac, like a water-pipe across a hollow piece of ground! are, I think, the most certain means of causing ulceration. It is indeed here, as in many operations, that the more the surgeon trusts to his own curious machines and firm ligatures, and the less he trusts to nature; or, in other words, the more of this coarse mechanical ingenuity the surgeon displays, the greater will his patient's danger be.

But there are various causes of this erosion and ulceration of the artery, and, among others, the foul suppuration of the aneurismal sac; for the cleansing of an aneurismal sac is like the sloughing of a gunshot wound; it is rather a gangrene and sloughing than a proper suppuration of the cavity. I know of no sore more difficult to heal than an aneurismal sac; it sometimes falls into actual gangrene; and this peculiar condition of it depends not upon the putrid tendency of the blood, but upon the force with which the blood is driven in, and, as it were, injected among the cellular substance. When blood, either from the bursting of smaller vessels, or from some more important aneurism, lies upon a bone, the bone is corrupted, and this caries is ascribed to the putrid tendency or dissolving power

* *Ligabanturque exiguo frusto corii crassioris munitæ ad arteriæ dissectionem vitandam.*—Ruisch.

of the blood! while it proceeds merely from this blood being driven into the cellular substance which surrounds the bone! for the blood thus driven into the cellular substance, either separates the periosteum from the bone, by being injected under it, or injures and deadens the periosteum, by being driven into the cellular substance of its outer layer; the periosteum is thus either directly detached, or soon detaches itself from the bone; and the bone, thus deprived of its nutritious membrane, becomes carious. Thus it happens that in the operation for aneurism, or upon opening the body after death, fragments of the bone are sometimes found detached, floating even in the blood, and then it is proclaimed that the bone has been in part dissolved by the blood, as if the blood were as peculiar in its nature as the Liquor Gastricus of a dog*.

The pathology of the aneurismal sac is nearly the same with this of a diseased bone. The blood is injected among the cellular substance, the parts are separated from each other, a foreign body (the blood) is driven in betwixt every fibre! the parts are moreover compressed by the general tension of the tumor, and all the parts are like the artery itself insulated, deprived of nourishment, ready to fall into gangrene. The aneurismal sac either falls into actual gangrene and bursts, or is at least on the borders of gangrene before it is opened. The pressure is reciprocal, and the surface does not thus give way before the parts within the sac are ready to fall into universal ulceration and to slough off; and when the sac bursts or is opened, the putrefaction of the blood augments the natural foetor and foulness of the suppuration. This is the reason of suppurations extending along the bed of the artery, for the blood is driven along in that sheath of cellular substance which surrounds it; this is the reason of the ulceration and erosion extending all along the insulated portion of the arterial canal; this is the reason of ligature after ligature giving way; and this is the reason why the artery is often more dangerously affected, more diseased and ulcerated even in recent wounds, than in natural aneurism and spontaneous dilatation of the artery! bursting of arteries, yielding of ligatures, sudden and fatal hæmorrhages are as frequent in recent wounds as in old aneurisms!

* "Sir John Pringle told me, says Dr. Monro, that he digested bones in putrid blood, but did not find that the blood had the least effect in dissolving them as a menstruum. *The stream of blood indeed, by continually washing the parts of the bones, laid bare by aneurisms, prevents the oily matter separated from the bones from stagnating and acquiring the strong foetid-smell and high degree of corruption observed in other caries.*" These are indeed curious and important speculations. Dr. Hunter's account of the corrupting power of the blood, viz. Med. Observ. and Inquiries, is much of the same complexion.

Mr. Leslie performed the operation for femoral aneurism upon a boy, whose artery had been struck with a pen knife, and whose aneurism had increased for three weeks, and then burst so as to endanger his life. This aneurism was recent, and was from a direct wound of the artery; it was in a young and healthy boy. Mr. Leslie had not only tied the artery securely, but had taken every precaution by proper compresses (and by tightening the tourniquet a very little) to moderate the force of the blood, "yet in half an hour after the operation, a fresh alarm was given, and the flux of blood appeared as great as at first." "He found, upon removing the dressings, that the first ligature had cut through the adjacent parts, which, from the operation being so long delayed, *had become putrid, and unable to make sufficient resistance*; by this means the pressure of the ligature upon the vessel was removed *." If this be the condition of the other parts, what must be the state of the artery itself, lying insulated in the centre of such a sac? What can this portion of the artery be good for, insulated, ulcerated, unfit in all respects to bear ligatures even in the first instance, and sure to give way under them in not many days?

It is from not foreseeing the ill consequences of it that the operator is tempted to go upon this dangerous ground; he ties the artery; he is at pains to keep it insulated; he is happy to think, that though it should give way, it will be within his reach; he knows where to find it; it bursts, and he ties it again. But in place of considering this part of the artery as of any value or likely to be useful, he would do well to consider it as dangerous; he should not by any means apply his ligatures close upon the breach or wound in the artery under pretence of saving inosculating branches; he should rather consider this as a portion of the artery, which, before the cure be accomplished, must be inevitably destroyed; he should tie the artery at the two extremities of the sac, as close as possible to the surrounding flesh; and should then cut it across, that it may shrink for protection among the flesh and heal soundly along with the rest of the suppurating sac.

OF SECONDARY HÆMORRHAGY FROM THE INOSCULATING BRANCHES.

There is still another kind of secondary hæmorrhagy, which arises neither from the fading of the parts, the slipping of the ligature, the bursting of the

*Vid. Dr. Duncan's Medical Commentary, Vol. II. p. 178.

artery, nor any other cause that has hitherto been imagined. The hæmorrhagy which I am now going to explain, does not even proceed from the main trunk of the artery; but, on the contrary, the life of the patient is endangered by hæmorrhagy from those very inosculating arteries upon which surgeons have always depended for the safety of the limb. It happens thus:

In every part of a limb, but especially round every joint, there are frequent inosculations of the smaller arterial branches, and they are thence named the ARTICULAR OR INOSCULATING ARTERIES. While the circulation in the main trunk of the artery is languid, these are gradually enlarging; when the aneurism is near bursting, the pressure upon all the adjacent parts is very great, and the articulating or inosculating arteries are still more enlarged; and the moment the operation of tying the main artery is performed, the whole blood of the limb passes through those arteries. These lateral arteries act with particular vigour, they inosculate very freely round the sac; sometimes branches of them are cut in the time of the operation, often they are eroded from the ulceration and gangrenous condition of the sac. This is a frequent cause of secondary hæmorrhagy, and much to be feared; the patient does not indeed expire with one gush of blood, as sometimes happens when the main artery of the thigh is ulcerated and gives way; these inosculating arteries lie deep at the bottom of the gangrenous sac; they are eroded, burst out, and fill the sac with blood; and before the surgeon can be called, or that blood cleaned out, the arteries have ceased to bleed, and are no longer to be found.

One thing more is particularly worthy of observation in regard to those arteries, that not only are they eroded when they are thus exposed in the bottom of an ulcerating sac; but in those cases where the sac is left entire, (the operation being performed according to Mr. Hunter's manner in the fore part of the thigh), these inosculating arteries open upon the internal surface of the sac, they convey that blood which should nourish the limb directly into the aneurismal sac; and though the main artery be actually stopped with a ligature in the fore part of the thigh, the pulsation of the aneurismal tumor in the ham returns upon the second or third day. Some years after the death of the late celebrated Mr. Pott, the following narrative of one of his operations was published: But, however correctly the facts may be stated, I will not allow myself to recite the case to you, without strongly expressing my disapprobation of many implied reproaches,

which never should have been thus publicly expressed, and, least of all, after Mr. Pott's death.

“ This mode of operating was adopted by Mr. Pott in a case of popliteal aneurism in St. Bartholomew's Hospital; which operation having been the object of medical attention for some time, I shall give a brief account of it, as I was present at the time it was performed.”

“ Mr. Pott began the operation by an incision, about five inches in length, upon the posterior part of the thigh, through the common integuments, a little higher than the tumor, and in the direction of the thigh, between the two hamstrings; he thence dissected down to the vessels at the upper end of the incision, which being there deep seated, proved both tedious and difficult. Having come to the vessels, a double ligature was passed, and the two portions tied separately, at nearly half an inch distance. The depth of the incision made it difficult for any but the operator, and those immediately assisting him, to see what was included in the ligature, and at the time the popliteal artery was supposed to be secured by it. The wound was dressed up in the common way. The second day after the operation, a pulsation was felt in the tumor, which afterwards enlarged so much, that Mr. Pott amputated the limb.”

“ It is said, that the aneurism appeared, upon examination of the limb, to have been in an anastomosing branch, not in the trunk of the artery *.”

“ The following remarks upon this operation will tend, in some measure, to illustrate the method recommended and practised by Mr. Hunter. The mode of taking up the artery in the ham must be always unfavourable to the future success of the operation, if either the artery itself should be diseased, or if the tumor, by being so contiguous to the violence done in the operation, should be affected by the consequent inflammation, which seems to have been the case in Mr. Pott's operation, as I understand two abscesses were formed close to the sides of the sac. Had the aneurism been situated in an anastomosing branch of the popliteal artery, given off below the ligature, there should have been no pulsation afterwards in the tumor; and were it in a branch going off above the ligature, the pulsation in the tumor should have continued immediately after the operation, and should have been increased by it, neither of which effects appear really

* How miserably ignorant must that person be of insculating arteries, and every thing of the kind, who can talk of an aneurism of the ham! being formed by an insculating artery!

to have taken place, which throws a doubt upon the situation of the aneurism, if the popliteal artery was rendered impervious by the compression of the ligature."

This case is a curious and happy illustration of the piece of pathology I have just explained to you. The insinuation contained in these words, "It was difficult for any but the operator to see," "the popliteal artery was supposed to be secured," &c. are very unbecoming. The pulsation returning the second day is an acknowledgment that the pulsation had actually ceased! The pulsation of the tumor could not have ceased the instant of the operation, nor have continued absent for two days, unless the femoral artery had been actually tied! it could not have returned from the ligature round the artery failing, for the artery was tied in a very secure manner with two ligatures, the one half an inch above the other. Had the pulsation returned from the sudden yielding of the ligature round the artery, the effect must have been sudden! but the second day after the operation, that pulsation was felt in the tumor, which afterwards enlarged so much that Mr. Pott amputated the limb." This implies a slow enlargement of the aneurism, such as might arise from the aneurismal sac being gradually filled by some inosculating artery. The illustrative remarks about the inosculating arteries only demonstrate how little the gentleman who wrote those cruel reflections knew about the effect of inosculating arteries. But as if Providence had designed a judgment upon him, the very same misfortune happened to himself in the following case:

"A labouring man, who was employed about a pipe manufactory in collecting and carrying the pipes, felt, after a long walk, an indistinct heavy kind of pain extending down the calf of his right leg. This first pain very soon ceased, but it returned from time to time as he resumed his wonted employment, and became daily more frequent and violent, till he was forced to confine himself; then, for the first time, he observed a tumor in his ham; and when in the end he presented himself at the Hospital, there was formed a popliteal aneurism of considerable size, painful, pulsating strongly, with a throbbing motion, not only perceptible to the touch, but manifest to the eye."

"The operation for popliteal aneurism was performed according to Mr. Hunter's method, with perfect success; the artery was tied in the fore part of the thigh; the aneurism in the ham was left untouched; the pulsation of it ceased the moment the ligature was drawn; the ligature came away easily on the 12th

day; the wound healed; the tumor in the ham subsided rapidly; and in three weeks he was almost well."

"But during the cure of this aneurism, it was observed that another was forming in the artery of the left ham. As soon therefore as his health was somewhat restored by country air, he was brought once more to the Hospital to undergo the same operation in the other leg. This second aneurism had now acquired an alarming size; the operation was performed; and the pulsation in the aneurism ceased the moment the ligature was drawn upon the artery on the fore part of the thigh; but the following morning the patient was sensible of a violent throbbing in the tumor; and though the surgeon could not feel any pulsation, the pupils felt it. On the next day, the third from the operation, this question was decided; the pulsation was manifest to the eye as well as to the hand of every one; and the force of the pulsation distinctly increasing was the reason of calling a consultation wherein amputation was strenuously recommended by the other surgeons of the Hospital; but the operator himself was more prudent, and wished to try for a few days at least the effect of compression. The wound in the fore part of the thigh looked unhealthy; at the end of the week a hæmorrhagy took place; the blood flowed profusely, yet was easily stopped; it returned no less than four times within the twenty-four hours, but not a great deal of blood was lost."

"On the morning of the tenth day, the surgeon pulled at the ligature, but without getting it away; having pulled with some force, a smart hæmorrhagy followed; the stream of blood was florid, and flowed, per saltim, but it was small, and could not be from the femoral artery, it must have been a branch only. The compress was now removed from the tumor of the ham, lest the blood should be hindered from passing downwards; and was applied to the wound over the ligature to restrain the hæmorrhagy."

"The hæmorrhagy was thus suppressed; but this compression of the wound produced a very violent swelling and inflammation, threatening abscess. It was only on the sixteenth day that the ligature came away; the compress was removed; the patient was bled, and kept very low, and in two days the symptoms of inflammation subsided; and the pulsation of the aneurismal sac, which had become very strong, entirely ceased."

I will not call those cruel remarks on Mr. Pott a posthumous assassination, nor name the person who could commit the act; I say nothing severe of his own operation; I accuse him of nothing wrong. I believe sincerely that there was no

thing in this operation done imprudently, nothing left undone. I am indeed informed, upon the very best authority, that his operation was dexterously and rapidly performed; but, by thus liberally acquitting him of any fault in his own operation, I leave him but the more responsible for what he has said concerning so great a surgeon as Mr. Pott; and I state both cases in proof of these pathological conclusions, "That often secondary hæmorrhagy arises from these anastomosing arteries being dilated and eroded, or wounded in the operation, the blood welling out at various points from the walls and bottom of the sac;" and "that not unfrequently, after the great artery of the limb has been fairly tied, the aneurismal sac fills again, the pulsation is renewed, and the aneurism resumes its characteristic marks, in consequence of some inosculating artery pouring its blood into the sac. From the moment of the operation for aneurism the inosculating arteries are enlarging! by the second or third day they are able to communicate their pulsation to the sac just as in performing the operation for aneurism of the arm, the pulse of the wrist is felt by the evening of the second day. But of this secondary aneurism I should be less afraid than of a secondary bleeding; for the pressure of the effused blood, the weight of the surrounding parts, the resistance even of the sac itself, these forces, which cannot indeed resist the whole force of the femoral artery, will certainly be able to oppose that of an inosculating branch no bigger than a crow quill. While the sac is filling with blood, the increasing pulsation of the bag becoming stronger and stronger every moment, must be alarming! yet the resistance will increase in due proportion, the tumor will become stationary, and a slight pressure will accomplish the cure; for the inosculating artery, which is thus active in filling the aneurismal sac, is small, solitary, and unsupported; it does not lie in the direct line of the femoral artery, but is always curled; it has no direct communication with the lower arteries, and is not solicited to act; in short, it is not like the femoral artery, a parent trunk to many lesser arteries, whose constant activity solicits a stream of blood through it! This inosculating artery is but one of many enlarged branches, by which the limb is nourished; and no sooner is it resisted by the fullness of the sac which it enters into, and by the increasing pressure of the parts, than the blood turns aside into the other channels, and ceases to force the aneurismal sac. There are, besides, accidents favourable to the cure of this secondary aneurism, inflammation, for example, as in this last operation, where the swelled state of the parts increases the resistance; and, accordingly, no sooner

did the inflammatory swelling in this case subside, than it was discovered that this threatening pulsation and extension of the aneurismal sac had ceased.

In amputation, secondary hæmorrhagy happens only, when along with the great artery we have tied in the nerve, and tied it so firm, that the ligature will not come away; or, when we have amputated so ill that the bone projects, the flesh shrinks, the skin retracts, and the whole face of the stump, in place of adhering, ulcerates, and opens up; or, lastly, in those bad constitutions of the air, in which hospital ulcer is frequent, for when that kind of gangrene opens up a stump, the sloughing is like the sloughing of a gunshot wound, or of a foul aneurismal sac, the parts are successively destroyed, the blood vessels at last give way, one after another, and the patient dies of secondary hæmorrhagy.

CONCLUSION.

Thus have I endeavoured to investigate, in a general way, the causes of secondary hæmorrhagy: I ascribe the most dangerous bleedings, both in amputation and in aneurism, to the ulceration of the great artery; some of the causes I hope I have explained to your satisfaction, and the practical conclusion which I would deduce from this doctrine is of no small importance; it has relation more or less direct, to every great operation; and therefore reflect, I beseech you, on those facts and principles, and judge for yourselves. It is my opinion, that a great artery never can be safe while the ligature remains about it; for till it comes away, the artery cannot be said to have adhered, cannot be buried in granulations, nor supported by the surrounding flesh, cannot be out of danger of ulceration! Nor can a great artery ever be safe while it remains insulated, though surgeons seem to take a pleasure in seeing it lying fair along in the cavity of an aneurismal sac! but they should recollect, that if the artery lies more within their reach of operation it is also surer to need it; being thus insulated, stripped of its cellular substance, deprived of its nutritious vessels, the part which is included betwixt the two ligatures must gangrene; the parts under the two ligatures often, in place of adhering, will ulcerate, the ulceration, in place of stopping when the ligatures fall off, will continue, and as the artery is an insensible and firm part, entering slowly into disease, it ulcerates slowly, and bursts only on the tenth, twelfth,

or fifteenth day. We have reason then to believe that the oldest practice is the best; that whenever a great artery is tied, it should be cut across betwixt the two ligatures, that it may shrink and bury itself among the surrounding flesh. We know two important facts which direct us to this bold practice: First, That wherever we do tie an artery with two ligatures, the intermediate piece is inevitably destroyed, and it were surely more prudent to cut the part across with the knife, than to allow it to be thus slowly destroyed by ligatures, with danger of the ulceration extending along the artery thus stretched out, and held insulated. Secondly, We know that though we are never alarmed with the femoral artery bursting in amputation where the ligatures come easily away, yet in aneurism our ligatures remain too long, they seldom loosen till the twelfth or fifteenth day, and there have been few operations in which secondary hæmorrhages do not make part of the narrative of the case.

I think that, by cutting across the artery, tied in aneurism, we should put it nearly in the same condition with that tied upon the face of an amputated stump. In operating in any considerable aneurism, then I would be careful to cleanse the sac thoroughly of its putrid blood; I would not merely open the general fascia of the limb, but dissect carefully that peculiar sheath which encloses the great artery, veins, and nerve; I would tie the artery clear of the nerves, which, being indestructible, hold the ligatures too long; and I would have it clear also of muscular flesh, which, while it detains the ligature, prevents it operating fully upon the artery: The bare artery I would tie with moderate firmness, with a ligature smaller than is commonly used, and as near as possible to the sound parts. I would not insulate it with pieces of leather or cork, nor lay compresses along its course, but cut it across, that it might shrink among the surrounding flesh. In tying a great artery, I would take every precaution that might ensure the effect of the ligature upon the bare artery, and enable me to draw it early away; and I would be especially careful to prevent my ligature being embarrassed with the surrounding parts.

But this subject grows too important to be confined within the limits of this discourse, the principles which are here laid down have a very general relation to the surgery of arteries; and when I shall next proceed in regular order to explain to you the aneurisms of the great arterial trunks, the signs of the disease, and the uncertainties and difficulties of each operation, you will perhaps feel the importance of those principles which I have endeavoured to establish.

DISCOURSE VI.

ON INOSCULATION.

A GENERAL SKETCH OF THE ARTERIAL SYSTEM; OF THE IMPORTANCE OF INOSCULATIONS TO THE GENERAL HEALTH AND PRESERVATION OF THE BODY; OF THE FREQUENT INTERRUPTIONS OF THE GREAT ARTERIES, AND OF THE RETROGRADE MOTIONS OF THE BLOOD.

HORROR at the sight of blood is perhaps one of the most natural feelings, and next to that is the apprehension, that if hæmorrhagy were suppressed by tying up the main artery of a limb, gangrene and death would ensue! Gangrene has always been the greatest terror of the surgeon, and the tying a great artery has always been thought the most certain cause of it. Among the arteries which supply the upper and lower extremities, certain inosculating branches have become remarkable by their importance in disease; inosculations have been found (after the operation for aneurism), encircling the elbow joint, and supplying the place of the main artery; inosculations round the knee and ham have been sought for, and are presumed to exist; these inosculations have, of course, been particularly noticed, while it has escaped observation that inosculation is essential to the healthy constitution of all parts of the body; that the inosculation of arteries is not peculiar to any joint, limb, or organ of the body; that the inosculation of arteries is an essential provision of Nature for the free circulation of the blood; that no part is without inosculations sufficient to support it against all obstructions.

The intestines, the solid viscera, the brain, the womb, have their arteries from a variety of sources; they have many great and separate trunks, but all their branches have frequent inosculations. In the extremities the joints are surrounded in a particular manner with frequent inosculations, the obstruction of one artery never hinders the circulation of the blood, but according to the various postures of the body, according to the various fullness, distension, and contortion of the viscera, the blood enters by various channels, and moves at different times;

in opposite directions, along the same artery: Why, for example, should there be so free an inosculation in the great epiploic arteries of the stomach, unless the blood moved occasionally from the left artery into the right, or from the right artery into the left? The womb has its four arteries, with free inosculations among their several branches, and is supplied with its blood sometimes from the arteries of the right side, sometimes through those of the left, according to its inclination during pregnancy; for very generally the foetus is attached to one side, the womb rests obliquely upon the brim of the pelvis, one set of the uterine arteries is more particularly compressed, while the others convey the blood freely. The Brain has its four arteries, and often the Carotids have been obstructed, and the whole blood has run into the brain, through the Vertebral arteries, and circulated backwards towards the face, throat, and jaws, by the inosculating branches. The Thyroid gland has its four arteries, and when it is diseased, and when we try to cut it out, we find, to our great terror and embarrassment, the blood pouring, with equal violence, from every artery of the gland; and that while one inosculation is left, while one arterial mouth is open, it bleeds with more than the violence of a single artery, for it draws its blood from all those which inosculate with it. When our limbs rest upon one side, the blood runs in another direction: while we grasp, turn, bend, and exert the limbs in various ways, we are perpetually changing the direction of the blood; and though the communications of the arteries are less marked in other parts of the body than in the brain, womb, thyroid gland, and round the joints, we have reason to believe that such inosculations are universal; that they increase the force of the circulation, and are necessary to the free motion of the blood; that the blood often runs a retrograde course; that these frequent inosculations are essential to health, and competent to the supplying of the parts, in the accidents of wounds, obstruction, or disease*.

If surgery could continue to improve, and the books of the present day be altogether forgotten, it would not be easy to persuade a surgeon of the nineteenth century that amputation was at one time decisively recommended in all wounds of the great arteries, or that the most respectable writers, men old in practice, accustomed both to advise and to operate, oftentimes put up at the head of their most in-

* I have seen from some natural cause the artery of the arm obstructed, from the bending of the arm to some point beyond the wrist; but the artery was cut out by a rude dissector, and no conclusion could be formed from this singular and interesting fact.

interesting chapter, the following aphorism: "When the brachial or femoral artery is wounded, though the patient should not perish by the hæmorrhagy, the limb must soon die for want of nourishment!" A surgeon is not only vexed with the difficulties of finding or tying a great artery, he is distracted with fears and doubts about its success. He is warned, "that, in such case, the progress towards putrefaction will be very swift:" "That a wound of this kind very generally requires amputation." All intermission is cut off; not one precious moment is to be wasted in delay; not a moment is allowed for thought; not the slightest doubt is suggested in so difficult a question. While this rule remains unrefuted (a rule which no sensible man will conform to), the young surgeon is left in a distressing situation, he hears, indeed, reports of limbs being saved, but no otherwise than by miracle, he knows that the general rule of surgery is to cut them off! Naturally unwilling to perform such an operation, he shrinks from it, he performs rather the operation for aneurism, but every time he performs it he feels himself particularly responsible! he feels himself answerable for his patient's life every time that he refuses to comply with the common rule of amputating his limb.

There are innumerable accidents, as bruises, compound fractures, and gunshot wounds, in which the limb is so hurt, that, if along with these injuries the great artery be wounded, (driving its blood deep among the disordered parts), there is every danger that gangrene will ensue, but not from want of blood! we find anastomoses formed among the first branches of the great arterial trunks the moment they have emerged from the trunk of the body, such anastomoses as should preserve the whole circulating system even although the aorta itself were interrupted! I know of no part of the body in which the simple wound or interruption of the artery, uncombined with other injuries should prove fatal, I would tie the artery of the groin or axilla as confidently as I would tie the artery in the ham, or at the bend of the arm, I hope confidently to set up at the end of this discourse an axiom, the reverse of that which I have just mentioned; for I will endeavour to establish my conclusion on substantial proofs, while the old doctrine is, I assure you, founded on mere prejudice and groundless fear.

When I cast my eye over the general plan of the arterial system, I think I can mark out three chief points, where, by observing the connections of the arteries, we shall be able to lay sure grounds for very important conclusions.

First, I am ready to prove to you, that no sooner do the two great arteries of the axilla and of the groin emerge from the trunk of the body than they establish sufficient connections with each other (distant as they are) to ensure the continuance of life even though the aorta itself should be interrupted. Secondly, That the two great fleshy joints of the haunch and shoulder are so surrounded with copious anastomoses as to ensure the life of the extremities, though their arterial trunks were interrupted! and, Thirdly, That the anastomosing arteries, surrounding the smaller joints of the knee and elbow, are neither more conspicuous nor more effectual in preserving the circulation than those of the shoulder and haunch, though the surgeon has a perfect dependence on the one, and has as yet scarcely learnt the importance of the other. You are, I doubt not, prepared to follow me in this investigation, with a degree of interest fully equal to the tediousness of the inquiry.

1st, When the two great arteries of the arm and of the leg emerge from the trunk of the body, they send out each a very remarkable branch! From the subclavian artery goes off the internal mammary, which runs along through the thorax under the sternum, down to the scrobiculus cordis. The femoral artery, in like manner, sends off the epigastric artery, which turns backwards under the femoral ligament, runs along under the rectus muscle, rises to the scrobiculus cordis, and there terminates in anastomoses, with the mammary artery, forming a connection betwixt the two arterial trunks, which has been long remarked. This anastomosis I shall presently prove to you, is sufficient when the aorta itself is interrupted to supply the great artery of the thigh with blood.

2dly, The subclavian artery, just where it turns over the thorax, sends off several very remarkable branches. The branches of the thyroid and cervical arteries, long, slender, and considerable in respect of number, turn round the shoulder joint, and mix their extreme branches with those branches which come off from the brachial artery; and one branch is of remarkable size, the supra scapularis, which turns over the shoulder, enters the notch on the upper border of the scapula, and supplies much of the flesh which covers the scapula, it anastomoses in a particular manner with the subscapular artery. You have but to tie the axillary artery, and inject wax by the subclavian from within the thorax, you will find your wax run freely into the lower part of the brachial artery, and will be satisfied that those anastomoses are competent to the support of the limb.

In like manner, is the haunch furrounded with many arteries, which hold remarkable inosculation with the arteries of the thigh. They all turn round the pelvis, just as the cervical and humeral arteries turn round the scapula; they all inosculate with the profunda femoris, as the supra scapular branches inosculate with those of the humeral artery; the Ischiadic artery comes out through the Sciatic notch along with the sciatic nerve; the Thyriod artery comes out through the thyroid hole with the Thyroid nerve; the Pudic artery comes out by the side of the bladder to supply the parts of generation. All these branches have frequent inosculation with the two uppermost branches of the profunda, i. e. with the inner and outer articular arteries which surround the hip joint; and these inosculation are either so frequent, or so wide, that they convey an injection easily; if you tie the External Iliac artery, and inject from the Common Iliac, you will find your injection in the femoral artery, although the direct road to it be obstructed by the ligature. It is almost sufficient that I affirm that those inosculation permit an injected fluid to pass through the limb directly, and at one stroke of the syringe, without that slow insinuation of the blood, and dilatation of the arteries, which facilitates the effect in the living body; but I will moreover prove to you, by the most direct inference, that these inosculation are sufficient to save the limb even when the great artery is tied close to the arm-pit or groin, when the femoral artery itself is obliterated within the pelvis by disease, and the whole limb disordered by the extravasation of blood.

3dly, Round the joints of the elbow and knee there are well known inosculation, which have attracted particular notice, because of the frequency of aneurism in those two points of the arterial system. As the brachial artery advances towards the bend of the arm it gives off three arteries, the Profunda Superior, the Profunda Inferior, and the Ramus Anastomoticus Major. These three arteries, lying parallel with the main artery, are often named collateral arteries; they are very delicate and slender; they twine round the elbow joint, and they inosculate with three small arteries, which are reflected from the three great branches of the fore-arm. These retrograde twigs are very small; they are named Recurrens Radialis, Recurrens Ulnaris, and Recurrens Interossea, the whole apparatus of inosculating arteries consists of the most delicate and almost invisible twigs, it is indeed a fortunate injection that shows the communications of those twigs with each other. The elbow joint is naked and bony; the vessels delicate, long, and slender; the injection does not pass through those inosculation so freely as it

does round the inosculations of the fleshier joint of the shoulder; these vessels will hardly transmit tepid water, and yet they enlarge so easily, that the main artery may be tied with perfect confidence. The operation for aneurism has been performed some hundreds of times; and, notwithstanding the apprehensions of surgeons, never has a gangrene occurred from such a cause.

In like manner is the knee joint surrounded with inosculating arteries. The popliteal artery, as it approaches the bending of the ham, gives off branches exactly resembling those of the Humeral artery, and they are met by branches returning from the three great arteries of the leg, viz. from the Anterior tibial, the Posterior tibial, and the Fibular arteries. These also are long, slender, delicate arteries, injections penetrate them with difficulty, the artery in the ham being tied, the tibial arteries do not receive an injection thrown into the arteries of the thigh, and yet the articular arteries have so often saved the limb after the operation for aneurism in the ham, that when the operation fails, the mortification of the limb is to be attributed to causes very different from the want of blood.

The inosculations of all kinds of vessels are innumerable and perpetual, but in a practical review of the arterial inosculations, these three are the chief: First, The inosculations of the axillary and femoral arteries through the epigastric and mammary arteries. Secondly, The inosculations surrounding the fleshy joints of the Shoulder and Hip, viz. the Cervical and the Sciatic arteries; and, Thirdly, The slender inosculations which surround the naked joints of the elbow and knee, called the Articular or Inosculating arteries: I trust I shall be able to prove, that each of these has a degree of importance which has not hitherto been attached to it.

FIRST, OF THE INOSCULATIONS WHICH SUPPLY THE PLACE OF THE AORTA.

The first vascular connection which falls to be illustrated is that of the axillary artery, with the arteries of the thigh: Perhaps there are no two arteries of the body so far removed, and yet so immediately connected with each other. There is no inosculation more incapable of dilatation, nor more circuitous than this; and there is nothing in pathology more difficult to believe, than that the blood should pass by this rout from the subclavian to the femoral artery, or that two

small arteries, the mammaries and epigastric arteries should supply, in any degree, the want of the aorta, yet the fact is proved. " Mr. Paris, dissector for the amphitheatre of the Hotel Dieu, in the year 1789, injected the body of a very lean old woman, of about fifty years of age, whose arterial system was found to be singularly deranged, and the circle of the blood changed altogether, by a complete contraction of the aorta a little beyond the arch; and Mr. Paris had his attention particularly excited to the condition of this subject by the unaccountable enlargement of the small arteries upon the fore part of the chest. He had filled the arteries with an injection composed of equal parts of suet and rosin, coloured with lamp black; and this injection, thrown in from the mouth of the aorta, passed along so easily, that far from suspecting any obstruction, he felt that he could have thrown in more injection than is usually required for filling an adult body.

The subject was so meagre, that, without dissecting, Mr. Paris felt the thoracic arteries running down the sides of the chest, tortuous, and remarkably enlarged. It was natural for him to be very careful in the dissection of this subject. He found the aorta, immediately beyond its arch, contracted to the size of a writing quill! The coats of the artery were of their usual thickness, and its cavity of course extremely small; the arch of the aorta above this constriction was but very slightly dilated, the part below had lost nothing of its natural size. Nothing could be found, either in its own structure, or in the condition of the neighbouring parts, to account for this constriction of the artery.

The carotids were natural. The arteria innominata, and the left subclavian were enlarged to twice their natural diameter; and all their smaller branches had increased in the same proportion, and had assumed a curled and zig-zag course. The internal mammary and phrenic arteries were greatly enlarged and very tortuous. The transverse arteries of the neck were of twice their natural size. Their posterior branches were tortuous, extending to a great distance over the back, with long anastomoses, which were met from below by the branches of the Upper Intercostal arteries, and they were also remarkably enlarged; the thoracic and scapular arteries, which go along the sides of the chest, were of twice their natural size.

Below the constricted part of the aorta, the Lower Intercostals were remarkably enlarged, even to three or four times their natural size; each of them was dilated, but those were most affected which came off highest and nearest the

contracted part, and the posterior branch of each, which penetrates to the muscles of the back, was more dilated than that which runs betwixt the ribs: indeed, those posterior branches were so remarkably dilated with contortions so closely succeeding each other, that they resembled a necklace of beads; and their inosculations with the branches of the *Transversalis Cervicis* were very remarkable. The Lower Phrenic artery was enlarged, holding considerable inosculations with the superior phrenic; and the Epigastric artery was dilated to the size of the enlarged mammary artery, and was joined with it by very numerous and very conspicuous inosculations * !”

The import of this very remarkable dissection you cannot fail to perceive, and I dare say you have been employed in remarking, while I described these dilated branches, the several inosculations, and in matching branch with branch among those enlarged arteries. I need not enter into any minute analysis, of this phenomenon, but some conclusions which the author has neglected I will venture to supply. By this constriction of the aorta, it was divided into two portions, and all its lower parts were deprived of blood. The carotids were not dilated, because they pass on directly to the head, and give no branches which could inosculate with branches from the lower part of this obstructed aorta. The subclavian arteries were remarkably enlarged, because the whole circulation of the body was to depend upon their smallest branches, these small branches were, by their dilation, and by their number, to compensate for the want of any more direct communications betwixt the upper and the lower parts of the aorta! for of the lower aorta, the whole wanted blood from the top of the thorax downwards all through the abdomen; the lower extremities also wanted blood. This blood then was supplied from other sources: It was delivered into the aorta at two points, one set of inosculating arteries opened into the thoracic aorta, and supplied blood for the abdomen, while another set opened into the iliac or femoral artery, and supplied blood to the lower extremities. First, The arteries passing off from the subclavian round the back and shoulders, i. e. the transverse arteries of the neck, and the transverse artery of the shoulder, were of twice their natural size; they extended over the back, and ended in long and tortuous inosculations with the posterior branches of the intercostal arteries, which were dilated and twisted so as to resemble a string of beads; and the upper inter-

* *Vide* Desfault's *Journal de Chirurgie*, Tom. II. p. 108.

costal, which comes off from the subclavian artery, within the chest, being enlarged, and inosculating with the lower intercostal arteries which come off from the aorta below the third rib (and below the constriction), assisted in filling the great trunk of the aorta with blood; which also received some from the enlargement and mutual inosculations of the upper and lower diaphragmatic arteries.

The artery of the thigh, on the other hand, was filled with blood, which passed from the subclavian along the internal mammary artery; this internal mammary was reinforced by inosculations with the thoracic or external mammary arteries, while the blood of both mammary arteries poured into the femoral artery through the Epigastric. The blood in most parts of the body was retrograde; the smallest arteries of the body, the most slender, those of the most delicate inosculations, were made to stand in place of the aorta itself. The blood reached the trunk of the aorta through long and small arteries, twining in a tortuous form round the back and shoulders! The blood of the femoral artery reached it from the subclavian, by the long and slender inosculations of the mammary and epigastric, running directly down the fore part of the belly. "The part of the aorta immediately above the constriction was scarcely dilated. The part below had lost nothing of its natural size." The pressure then had fallen very light upon the constricted part of the aorta, no dilatation, nor the slightest appearance of aneurism, had been produced by the action and pressure of the heart, forcing the blood through this stricture, none but the smallest arteries, those farthest removed from the force of the heart, had dilated, rather by the demand of blood upon them, and by their own increased action, than by the vis a tergo. It would thus appear that the stroke of the heart, is not essential to the reaction of the arterial system! That if arteries be but filled, they will be excited, and will, by their own muscular power, propel their blood.

Nor need we wonder at this complete obliteration of the canal of the aorta; it is not without a parallel in the other important vessels of the body; those even on which life and nourishment most immediately depend. My friend, Dr. Bailly, found the Vena Cava obliterated from the kidney to the diaphragm, it was closed at that very place where it should immediately discharge the whole congregated blood of the lower extremities and pelvis into the heart. So entirely was the cava obstructed that air could not pass. The blood went by a very circuitous rout; the emulgent vein was dilated; the small lumbar veins were enlarged;

the thoracic veins, and especially the vena azygos, were distended so as to receive all the blood of the lower cava. That blood which should have passed in under the liver, ascended to the subclavian vein; and the lower cava was represented by the small thoracic veins and vena azygos, just as the aorta, in the case I have now related, was represented by the small intercostal arteries.

The Thoracic Duct itself is often obliterated; the main duct is obstructed by tumors of the absorbent glands, or diseases of its valves; the adjoining absorbents dilate, so as to represent the proper thoracic duct; and indeed the long absorbent, which, running along by the left side of the aorta, carries, in such cases, all the absorbed fluids, is so peculiar in its form, place, and circumstances *, that I am almost persuaded the thoracic duct is double! that the absorbents of the loins, by which we inject, lead more directly to the greater branch of the duct on the right side, is the reason why it alone is known as the channel by which the chyle and lymph are carried into the circulating system, while obstruction from disease, or the application (while we are throwing in the injection) of a ligature round the root of the great thoracic duct, is necessary to point out to us the branch which lies along the left side of the aorta.

We perceive, then, that there are formed, even in the trunks of these great vessels, such anastomoses as ensure the continuance of life, when the Thoracic Duct, the Vena Cava, the Aorta itself, are stopped up. Nature, even in these desperate emergencies, has provided against that gangrene, and death, which narrow sighted physiologists have ventured to prognosticate, where only the lesser arteries of the limbs are interrupted. We can have no doubt of the perfect power of the anastomosing vessels in all other parts of the body, but we take particular pleasure in investigating the effect of the anastomoses which surround the great joints of the shoulder and haunch, because the investigation is itself one continued review of many important cures and operations, and each conclusion is of the highest importance in practical surgery.

* Mr. Astley Cooper has published, in the Medical Records of London, a very neat, short, and well composed paper, on the obstruction of the thoracic duct, accompanied with a drawing, and with many very ingenious observations, which lead me strongly to suspect that this long lymphatic is more important than is imagined; that the thoracic duct is absolutely double.

SECONDLY, OF THE INOSCULATIONS WHICH SUPPLY THE PLACE OF THE FEMORAL ARTERY.

Surgery and anatomy, which should go hand in hand, have not only been seldom combined, but have actually been the separate studies of two distinct sets of men. Physicians, and professed anatomists, have written in their closets, conjectures and cautions, and schemes of operations! while surgeons, far from being able to compare those conjectures with the truth of their own art, have humbly received them as absolute rules. Unless from mere caprice, or the hopes of saying something ingenious, physicians have been at little pains to study the common operations. But when a question presents itself of such high importance as this, "What are the branches which save the limb when its main artery is tied?" We should hope to find a point so easy of solution, very early studied and explained, and yet no one artery has been thoroughly studied, nor has any one set of inosculating arteries been truly investigated! The greatest anatomists have written on these subjects with unaccountable indifference and carelessness: They knew not that the femoral artery divided in the middle of the thigh: They knew the *arteria profunda femoris* only as an accidental artery: They described it as a *lufus naturæ*, and made their experiments and dissections, not on the bodies of men, but on horses and dogs!

The celebrated Vesalius hardly knew the profunda; we see it indeed in his plate; but we observe it only because we know the artery, and the importance which it now has in the eye of the modern surgeon; for though it is marked ($\psi. \chi.$), and is represented in his plate inosculating slightly with the arteries of the pelvis, it is not drawn truly, nor well explained*. This plan or drawing of Vesalius, though more elegantly engraved, is less true and accurate than that of Eustachius; for in the *Tabula XV.* of Eustachius we find the profunda distinctly marked, but yet it is not characterized with any of those inosculations which give it its chief importance in the eye of the surgeon; it is not even so fully drawn as to attract the notice of the careful Albinus, who, in his explanation of Eustachius's Tables,

* Vesalius, however, observes, and marks one very large anastomosis of the profunda with the thyroid artery. Vid. *Integra totius magnæ arteriæ delineatio.*

has passed over this artery in silence, while he should have marked T. fig. 15. as the great arteria and vena profunda femoris, going down together into the flesh of the thigh. In Verhein this great artery is represented in its true proportion to the arterial trunk; but it appears in his plan as one long and simple branch, not having that importance nor those wide anastomoses which constitute its chief character.

Heister comes after all these anatomists, and being himself an anatomist and a practical surgeon, we should have expected from him, better things. He blames all former authors, Verhein excepted, for having neglected this important branch, "which after all, says he, is not so very rare†." This one expression shows how poorly he understood what he ventured to criticise. He regards the artery always as a variety, as a mere accident: He compares this double artery of the thigh with the accidental division of the humeral artery above the bend of the arm; and that we may not mistake his illustration, he draws upon the same plate, with a wounded femoral artery, a high division of the arteries of the arm.

It may be said truly that all former authors knew this artery; Heister alone did not know it, nor had he at all profited by the discoveries of those whom he ventured to criticise. Vesalius, Eustachius, Verhein, Cowper, all drew this artery, some with more, and some with less accuracy; and their drawings being designed as general plans of the arterial system, it must be presumed that they regarded this as a constant and regular artery, while Heister alone speaks of it as an accidental artery! he mentions it as an accident peculiarly fortunate, when along with a wound of the main trunk there chances to be a double artery in the thigh. Yet Heister did not voluntarily take upon him to investigate this artery merely as a matter of speculation, the question was obtruded upon him as of the highest importance in practice. A shoemaker having dropped his paring knife from betwixt his teeth, clapped his knees together to catch it, and struck the point of the

† "Huic tanto magis miror, quod multi magni anatomici nullum prorsus mentionem fecerint; cum tamen non sit adeo rarus," p. 142. "Fere omnes anatomici, Verheyneo excepto, unicum tantum truncum et arteriæ cruralis et brachialis delinearunt, ut videre est in Eustachii, Vesalii, imo et in recentioribus præstantissimis anatomicis, Cowpero scilicet," p. 149. Let any man, who knows how the profunda should be drawn look to Cowper's third Table in his Appendix to Bidloo, and he will there find the drawing of the profunda, marked 70, nearly perfect, at least as good and as distinct as any other artery in his great plan of the aorta, and more correct than Verhein's. Thus much should be said in favour of our great English surgeon, who has suffered enough from accusations. Vid. Gulielmus Cowper, citatus coram tribunale Nobiliss. Ampliss. Societatis Britann. Regnæ.

knife into the femoral artery. Heister resolutely undertook the cure by compression, neglecting the old rule of surgery, which directs that every limb wounded in its great artery should be cut off. He undertook the cure only upon the presumption that there might perhaps be in this man a double artery: He delivers his opinion of the case in these terms: "If there be only one arterial trunk in this thigh, as often happens, then neither compression, nor ligature, nor any thing but amputation, can save the patient's life, the limb usually falls into absolute gangrene*. Heister resolved in this case, first, to try what could be done by compress and bandage, as if he had believed it possible to heal the artery; whereas, compression, whenever it suppresses bleeding, must do so by obliterating the cavity of the bleeding artery! Next he advises, if the compress do not suffice, to open up the wound, and tie the artery; and, as if the tying of the artery obliterated the trunk more fairly than the compress! he adds, "But if, having tied the artery, there should chance to be but one great trunk; (Imo, si forte non nisi unicus arteriæ truncus adesset) the leg must be cut off, otherwise it will mortify, and the patient die."

Heister not only explains himself thus upon an occasion, in which he was particularly interested, in understanding the femoral artery thoroughly; but he adds to this practical caveat, and to his undigested criticisms of Vesalius, Eustachius, and Cowper, a history of the femoral artery, worse in all respects than that of any anatomist who had gone before him; for he says, "The crural or femoral artery most commonly descends through the whole thigh, quite to the knee, in one single trunk, sending out only very trifling branches to the great muscles of the thigh to nourish them:." "But nevertheless it does sometimes divide in the upper part of the thigh into two great arteries†." That there might be one great trunk only was the chief apprehension of Heister, when in truth it would be as difficult to find a thigh wanting a profunda, as wanting a femoral artery.

But this mistake of Heister did not end with himself; there is another fur-

* Imo, si forte non nisi unicus arteriæ cruralis truncus hoc in femore adesset; sicut sæpe observari solet; subinde ne ligatura quidem arteriæ læsæ ad sanandum hoc malum sufficeret, quia tunc partes infra ligaturam positæ, ob sanguinis arteriosi hac ipsa sublatum influxum sphacelo corripi solent, ita ut æger tunc sine ablato crure summoque vitæ discrimine servari non possit.

† "Descendit arteria cruralis seu femoralis unico tantum plerumque trunco, per femur totum usque infra genu, et ut plurimum tantum minores ramulos ad musculos vicinos prægrandes nutriendos spargit," p. 141. "Interea tamen subinde in suprema fæmoris parte, in duos magnos quasi truncos se dividit," p. 142.

geon of the present day who is guilty of calling the profunda a *lufus naturæ*. Mr. Gooch mistakes this profunda, calls it an accidental branch, a *lufus naturæ*. He describes it as an accident fimilar to the high forking of the humeral artery ; he does not indeed clench it with Heifter's direct affirmation, "*Scilicet sæpe observari folet ;*" but he writes a paper in the Philosophical Tranfactions, to inform the world of this interesting difcovery, that he had three feveral times feen a double artery in the thigh. The terms in which Mr. Gooch describes this difcovery, which he made while performing an amputation, and which he thought might turn out fo interesting in consultations about aneurifms of the thigh, are thefe :

" In this amputation we obferved a divifion of the femoral artery into two trunks of equal fize running parallel ; and fo near together as that we could conveniently include them in one ligature with the needle, avoiding the nerve, after raifing them up with the diffecting forceps by a fmall portion of the connecting cellular membrane ; and here we found no occafion to take up any other vefsel." " This makes (fays Mr. Gooch) the third instance of this *lufus naturæ* which I have obferved*."

His amputation was particular only in this, that he had cut the thigh higher than ufual. " The two great trunks lying parallel, and equal in fize to each other," were the femoral artery and the profunda, and where he tied in one great ligature, both the femoral artery and the profunda, there was no wonder that he found no other bleeding arteries. Thefe are the only peculiarities that I can fee in this amputation, and I dare fay his other amputations were like this †. When fuch an author proceeds, in the next part of his paper, to retail to us his experiments (" made with the help of a famous farrier"), upon horfes and dogs, it is very allowable to fay, that fuch experiments were but a poor fubftitute for actual

* Vid. Philosophical Tranfactions 1775.

† The celebrated Profeflor Murray fays, " I never could find this fame double artery in the thigh, which Gooch pretends to have found three times, and believes to occur very often." "*Nec unquam mihi arteriam femoralem superficialem duplicam videre licuit, qualem celebr. Gooch fe ter obfervaffe contendit, &c.*" p. 44. No wonder that Murray never found any fuch thing, for Murray knew what the profunda was, and perhaps was not fo well acquainted with the Englifh language as to underftand that Mr. Gooch was calling the arteria profunda, a *lufus naturæ*, a double femoral artery, &c. was looking out for it in horfes and dogs. That Gooch did not know the profunda, is plain from this, that he never once mentions it in his Surgery, nor in his Royal Society paper. Mr. Gooch's opinion, and indeed his experiments, are repeated in that edition of his Surgery, which was publifhed in 1792.

The first of these is the fact that the United States is a young nation. It is only about 150 years old, and its history is therefore a history of rapid growth and development. The second is the fact that the United States is a large nation. It covers a vast area of land, and its population is one of the largest in the world. The third is the fact that the United States is a diverse nation. It is made up of many different peoples, races, and religions, and this diversity has been one of its strengths.

The fourth is the fact that the United States is a free nation. It is a nation of free men and women, and this freedom has been one of its greatest achievements. The fifth is the fact that the United States is a powerful nation. It has a strong military, a powerful economy, and a great influence in the world.

The sixth is the fact that the United States is a nation of opportunity. It is a nation where anyone can succeed, and this has been one of its great attractions. The seventh is the fact that the United States is a nation of progress. It is a nation that is always moving forward, and this has been one of its great strengths.

The eighth is the fact that the United States is a nation of peace. It is a nation that has been at peace for a long time, and this has been one of its great achievements. The ninth is the fact that the United States is a nation of justice. It is a nation that stands for justice, and this has been one of its great strengths.

The tenth is the fact that the United States is a nation of hope. It is a nation that has a bright future, and this has been one of its great attractions.



a. The Arteria Iliaca Communis.

b. The Arteria Hypogastrica in the Pelvis.

c. The Femoral Artery.

d. The Arteria Profunda Femoris

e. The Arteria Articularis Externa.

f. The Cutaneous Veins lying by the Artery

dissections of the human body. And when surgeons seven years ago could venture to tie the femoral artery supported by no better hopes than this, we (knowing the profunda, and all its connections with other vessels) may be very bold in tying the artery freely, not only in the thigh, but even in the groin.

From this history then we may learn, that, till very lately, the lateral arteries of the ham were the only inosculating arteries known to the surgeon; they were remarkable by their enlargement in popliteal aneurism; they were obtruded, as it were, upon the notice of the surgeon, who knew of no inosculations any where higher in the limb. At last the profunda was remarked; how imperfectly it was understood, the foregoing history will explain, but inosculations were supposed to exist betwixt that artery and the artery of the ham; and upon this presumption merely, without any assurance of such inosculations, the surgeon ventured at last to tie the femoral artery in the middle of the thigh, but he would not for the world have ventured to tie it above that point where the profunda is given off! Will it be believed that men wounded in the upper part of the thigh, and borne off alive from the field of battle, have been suffered to bleed to death from the mere apprehension of gangrene! as if this formidable gangrene would not have been as sure a consequence of the artery being wounded, and pouring out blood, as of its being safely tied up! better not reason at all than reason so imperfectly; better almost to be ignorant of anatomy than know so little; better trust to the mere impulse of humanity, which would prompt us to stop the effusion of blood, and to save the life in the first instance, let what would befall us afterwards.

I will now proceed to lay before you a true history of the femoral artery, such as will entitle me to that broad conclusion which I have claimed, viz. "That there is no part of the body which is not endowed with inosculations sufficient to save it from all danger of gangrene when the trunk of the artery is obstructed*."

* The drawings of the femoral artery will be very interesting to those who are at the pains to read this sketch of the anatomy of it, and to the practical surgeon it will be peculiarly desirable. He will learn from number first, the place of the femoral artery; the express point at which it gives off the profunda; the course it takes in running down the thigh; its relation to the sartorius muscle, and he will remark the forms of the muscles of the thigh; he will recognise the line of the rectus at (g); at (h) he will remark the fleshiest part of the vastus internus; at (k) he will remark the fleshy belly of the great muscle, the triceps, and he will be careful to remember that at (i), that is above the belly of the vastus internus, the femoral artery perforates the thigh, gets into the ham, and assumes the name of popliteal artery.

I desired one of my pupils (Mr. Mochler, a very diligent and sensible young man) to cut up a thigh, so that I might make a surgical piece of anatomy, and draw from it a general view of the femoral artery, and explain its relation to the thigh, and next to cut me out the injected artery of the same thigh, so that I might

The great artery, the Aorta, descends along the spine, and near the top of the pelvis, forks into the two iliac arteries, which are destined for the lower extremities; and each of these common iliac arteries, having passed downwards into the pelvis, is again divided into two arteries, the internal iliac, or hypogastric artery, which distributes its branches to the contents of the pelvis, (supplying also the great muscles of the hip, and the upper part of the thigh), and the external iliac, or great femoral artery, which runs down along the thigh.

The INTERNAL ILIAC, or, as it is often named, the Hypogastric Artery, gives branches to the rectum, vagina, and womb, and, in man, to the urinary bladder and prostate gland; it gives arteries to the bones of the pelvis itself, and most especially to the os sacrum; but its greatest branches are four muscular arteries which pass out through the several openings of the pelvis to the muscles of the hip, thigh, and pudenda. They turn round the os innominatum much in the same manner that those scapular arteries which nourish the flesh of the shoulder turn round the scapula. The Glutæal Artery, the largest, turns round the haunch bone backwards and upwards; it serves the glutæal muscles: the Ischiadic Artery turns round the os ischium, and its branches turn downwards towards the hip: the Thyroid Artery is one which passes directly forward through the thyroid hole in the fore part of the pelvis; it is smaller than these; but it plunges into the very centre (as we may express it) of the thigh; it runs in among the heads of the triceps, pectineus and rectus muscles; it is in the centre of the thickest and fleshiest part of the thigh; it is also close upon the joint of the thigh bone with the os innominatum: the Pudic Artery is the fourth; it is so named from its being appropriated to the parts of generation; its main branch goes to the root of the Penis, while its muscular and largest branches pass out by the side of the Bulb of the urethra, and scatter upon the perinæum, holding but a slight connection with the arteries of the thigh. These are the chief branches of the Internal Iliac Artery; they entirely encircle the fleshy joint of the hip, and they form many and powerful anastomoses with the upper arteries of the thigh.

The External Iliac, which divides from the hypogastric at the side of the os sacrum, turns along the side of the pelvis, and emerges from the belly by passing under the crural arch; it then sends the epigastric artery upwards along the muscles of the belly, and the Iliaca Reflexa, a small reflected artery backwards a-

draw a tree of the artery, such as would represent the great subdivisions of the artery, and the general tendency of its anastomosing branches.

long the border of the os ilium. The femoral artery then bends downwards from the groin along the inner side of the thigh, and near the groin at the top of the thigh, about five inches under the crural ligament it divides into two great arteries, equal almost in size, the one appropriated to the thigh and the other destined for the leg. The artery which is destined for the leg passes almost superficially along the fore part of the thigh, while that branch which belongs to the thigh itself plunges immediately into the thick flesh of the thigh; it spreads its branches to the very centre of the thigh, whence it is named Profunda Femoris; it is appropriated to the great muscles of the thigh, whence it was known among the older anatomists by the name of Muscular Artery of the Thigh; in size it equals the trunk of the artery, and is more widely distributed than any other artery of the body. Its trunk, where it comes off from the femoral artery, is thick and short, and its branches spread upwards towards the hip joint, or downwards towards the back part of the thigh. Two large branches turn suddenly upwards, they surround the hip joint by twining round it in all directions, they are large at this root, but soon spread into innumerable small twigs, their inosculations with the arteries which come out from the pelvis are very frequent; these two branches, from their surrounding the inner and outer sides of the joint, are named the External and Internal Circumflex Arteries. The profunda, as it works its way downwards among the muscles of the thigh, divides (from step to step as it goes down from muscle to muscle) into three or four great branches; these pass through the triceps from the fore to the back part of the thigh, whence they are named the Four Perforating Arteries; and these in their turn inosculate downwards with the articular arteries of the knee joint.

The main trunk of the artery, that which is usually named the Femoral Artery, having sent off this great branch, which supplies the muscles, runs obliquely downwards along the inner side of the limb, superficial or almost so, lying only under the skin and the strong fascia of the thigh; it winds obliquely along the thigh in the exact course of the sartorius muscle; it penetrates about two-thirds down the thigh through the tendon of the Triceps muscle, and so passes from the fore part of the thigh into the cavity of the ham; it is simple, and unconnected with muscles; it gives no branches of any importance where it lies along the thigh; it sends off only small cutaneous and muscular twigs. When the femoral artery passes through the triceps, and arrives in the ham, it gives five long slender arteries to

the knee joint, they are of the size of crows quills; they encircle the joint in every direction; three go off a little above the joint and three below, whence they are named the Upper and Lower Articular Arteries; they are named Collateral Arteries sometimes, and often Inosculating Arteries; they belong almost exclusively to the tendons, capsule, and burfæ of the joint, while some of their branches enter into its cavity to supply the ligaments and fat. But the femoral artery, unexhausted by these cutaneous twigs or articular branches, arrives at the top of the leg; lies close to the joint; attaches itself to the bones as if for support and safety; it divides a little below the gartering-places into three great branches, named Tibial and Fibular Arteries; and these, like the Radial, Ulnar, and Interosseous arteries, run downwards along the bones.

These are the three arteries of the pelvis of the thigh, and of the leg; and, when you cast your eye upon the plan, these things will strike you! That the glutæal, sciadic, and pudic arteries, which surround the pelvis, and scatter such a profusion of branches in all directions, resemble those which surround the scapula. That the main artery of the limb, since it lies almost superficial along the fore part of the thigh, runs down unexhausted to the ham, and there divides into the three arteries which nourish the leg! should be named, not the Femoral, but the Crural Artery; while the Profunda, a deeper artery, since it goes solely to the muscles, is the proper artery of the thigh. That this arteria profunda being as big as the femoral artery, having numerous branches, which run upwards towards the hip joint, and downwards towards the knee, must have large inosculations, whence we may be assured, that if it can draw blood from above it will easily transmit it to the lower parts of the limb; in short, that so great an artery must be quite competent to the nourishment of the thigh, although the main trunk were interrupted. The profunda lies as a great inosculating trunk betwixt the arteries of the pelvis and the arteries of the ham; its first branches turn upwards to meet those from within the pelvis, its lower branches turn downwards to meet the articular arteries of the knee, although it be the proper office of this great artery to nourish the thigh, yet one accidental, but very important office, is to inosculate with other arteries. It is thus by these conjoined offices that the economy of the limb is perfect; that it is nourished during health, and supported by new circles of blood when any accident affects the main artery.

This succession of inosculations all along the limb must appear very interesting to you; those which are formed in the ham by the articular arteries have been



Arteries of the Pelvis.

- a. The Common Iliac.*
- b. The Hypogastric.*
- c. The Gluteal.*
- d. The Ischiatic.*
- e. The Pudic.*
- f. The Thyroid.*
- g. The Epigastric.*

Arteries of The Thigh.

- h. The Femoral Artery.*
- i. The great Arteria Profunda.*
- 1. Its External Circumflex Artery.*
- 2. Its Internal Circumflex Artery.*
- 3. 4. 5. Three of its Perforating Arteries.*
- k. l. The Popliteal Artery.*
- m. m. m. Its Articular Arteries.*

n. o. p. The three Arteries of the Leg.

long remarked, because they are enlarged in popliteal aneurism and save the limb ; yet they are in their natural state too delicate to receive water, or to allow it to pass easily. Those which surround the hip joint, formed by the upper branches of the profunda with the arteries from within the pelvis, are more numerous, in proportion as the joint is fleshier and larger ; they receive easily injections of wax while we can hardly force water into those surrounding the knee ; yet they have never been observed, nor has any surgeon ventured to tie the femoral artery above the profunda ; as if the profunda were a particular vessel, appointed by nature in a certain part of the limb to facilitate the surgeon's operations when he chose to perform them !

The succession of inosculations is so perfect, that were the main artery obstructed even within the pelvis, or at the groin, innumerable branches of the sciatic and thyroid arteries would pour the blood through the upper branches of the profunda, and from the mouth of the profunda into the femoral artery ! Were the femoral artery obstructed in the thigh, the trunk of the profunda would convey the blood freely, the numerous branches of the profunda would distribute that blood for the nourishment of the thigh ; and some inosculating branches enlarging more than the others, would carry the blood round the obstructed part of the artery, and convey it with a full stream into the artery at the ham ! Should both the profunda and the femoral artery be abridged, or obstructed, or quite destroyed, the long and slender branches of those arteries receiving the whole blood of their parent trunks, would enter into a powerful action, and dilate so as to convey the blood effectually along the back part of the limb from the hip to the ham ! That such long and slender arteries should become effectual arterial trunks, should represent the main artery, and convey the whole blood of the limb, must seem incredible, till I shall have produced the proofs, every one of which is in itself important.

The theorem, then, which I have now to prove is this, that not the femoral artery only may be safely tied in the middle of the thigh, but that the femoral artery, the profunda, and even the iliac artery within the pelvis, may all be obliterated without the limb falling into gangrene. This must be established, not by alleging probable consequences, but by plain facts ; and I enter the more willingly on this proof, because it includes, *a fortiori*, the true doctrine of wounds in all the lower parts of the limb.

“ Guattani was called to a man of thirty years of age, who lay ill in bed with an aneurism of the groin, accompanied with fever, which proceeded merely from the

excruciating pain. The tumor was close upon the fallopian ligament, hard, firm, of the size of a large quince, colourless, but with an intense pulsation; and the whole limb was distended almost to bursting."

"Guattani had expected to cure even this aneurism by gentle compression. He was indeed at one time flattered with hopes of success: the fever had subsided; the pain had ceased; there was a sensible lessening of the tumor, so that he found it necessary to draw his rollers closer from day to day; for a whole month did he indulge the hope of accomplishing the cure. But while the tumor seemed thus yielding to the compression, it burst during the night, with intense pain, and the attendants were obliged instantly to cut the bandages and give the patient relief. Then the blood rushing forwards among the cellular substance, which surrounds the psoas muscle, produced so sudden an enlargement of the tumor, that Guattani, at the next visit, perceived that all hopes of a cure were at an end; bandages could no longer be applied; no endeavours to appease the pain, or restrain the tumor, were of the smallest service; from day to day the tumor extended; it came plainly from within the pelvis; it filled the whole Hypochondrium, extended along the groin, and reached the middle of the thigh: with this prodigious tumor, hard, firm, pulsating strongly, and filling the haunch both within and without! the man lingered four weeks and then expired."

The conclusion which I am to draw from this interesting case is not undisputed. The celebrated Murray will not allow that the bursting of the artery implied a total change in the current of the blood. "Although (says Murray), Guattani was able to push an injection of tepid water, tinged with yellow, from the glutæal artery round into the trunk of the femoral artery, yet do I suspect strongly, that the grosser fluid, the blood, would pass through the same channels more difficultly; nay, so sparingly, as not to nourish the limb." But I will relieve you from all doubts by explaining the state of the parts. Twenty-four hours after death the body was dissected. Upon opening the abdomen, the coagulated blood was found to extend upwards along the whole bed of the psoas muscle, and downwards nearly to the middle of the thigh. This blood being removed, the iliac artery was found torn where it runs along the edge of the os innominatum. The laceration was four inches in length; was on that side of the artery which lies upon the os ilium; began about an inch below the giving off of the internal hypogastric artery, and terminated near the ligament of the groin. The blood had escaped from the back part of the artery, it had been injected under the back

part of the muscles, and among the cellular substance, which belongs to the periosteum of the bones. The artery was raised up from its bed of cellular substance by this extravasation, and pressed strongly forwards, not only against the peritoneum, but against the muscles and skin, and was wonderfully flattened, so as to prevent its conveying any blood to the limb. The bones were carious and spinous; the capsule of the hip joint was destroyed; and the head of the thigh bone was entirely displaced.

This disorder and destruction of parts induced Guattani to investigate the whole course of the femoral artery, which he seems to have traced very carefully from the groin to the ham. He began his dissection where the laceration ended, viz. near the ligament of the thigh. He made from that point a longitudinal section of the artery, and found its caliber somewhat below its natural size, decreasing gradually as it proceeded down the thigh. Where the artery approached the ham he thought that it absolutely closed; but, upon examining carefully, he found it could still admit one of Anell's wires, though with difficulty. It enlarged again to its natural diameter when it had entered into the cavity of the ham*.

The circumstances of this case and dissection are, I think, decisive of this im-

* "Transactis horis viginti quatuor, accedere consultum duximus ad inspiciendum, rimandumque aneurysma; quamobrem, aperto imo ventre, tanta se nobis objecit concreti sanguinis copia, ut hæc superius per totam Psoas musculi longitudinem, inferius autem pene ad dimidium femur protenderetur. Omni igitur coagulato sanguine educto, cultroque anatomico communis ilacæ arteriæ directionem sequentes, interna vix pollicem transversum transacta iliaca, invenimus in externa rupturam aneurysmaticam, quæ spatio quatuor digitorum transversorum extendebatur versus ligamentum Falloppii, ubi ipsa arteria nomen cruralis acquirit."

"Quarto, hinc pariter factum esse, ut sanguis, sub ipsa arteria per totam ipsius longitudinem sibi viam patefaciens, Falloppii ligamentum transierit, femoris pene dimidium obsederit, hujusque articuli ita capsulam lacerarit, ut femur inde luxatum fuerit; factumque demum fuisse, ut ipsa arteria, a concreto sanguine antrosum sublata, et compressa fuerit adversus Peritoneum, adversus musculos, ipsamque cutem, atque ita quidem, ut cylindrica sua naturali figura orbata, mirumque in modum depressa impar evaserit ad sanguinem versus articulum afferendum."

"Ejusmodi casus in me cupiditatem maximam excitavit considerandi totius cruralis arteriæ tractum. Eapropter incipiens ego ubi aneurysmatica disruptio finem habebat, ibidemque sectionem longitudinalem instituens, arteriæ cavum jam solito minus esse conspexi, quumque hoc magis, magisque poplitem versus extenuaretur, mihi penitus occlusum, antequam ad illum accederet, visum fuit. Sed re accuratius inspecta, cognovi, tantum in arteria cavi relictum esse," &c.

"Popliteæ hujusce arteriæ angustatio evidentissime mihi videtur evincere, cruralem arteriam, ob compressionem in aneurysmatis loco a coagulato sanguine factam, non amplius ex iliaca externa recipere potuisse sanguinem, ut illum ad articulum ferret; secus enim poplitea non valuisset unquam ita restringi."

portant point. The artery thus constricted, straitened to such a degree that it could scarcely admit one of Anell's wires for searching the lachrymal ducts (a wire no bigger than a bristle) could surely transmit no blood, and was in no respect equal to the nourishment of the thigh. Had the continued trunk of the artery been capable of conveying blood, the bursting of the artery within the pelvis must have deprived it of all chance or possibility of receiving blood. Had this artery been entire in its upper part, and pervious below, so as to receive and transmit the blood easily, still it was in its middle so raised and stretched over the extravasated clots, as to prevent, to use Guattani's own words, one drop of blood passing along to the lower parts of the limb; not only the main artery was thus burst, distorted, and straitened, but all the collateral arteries must have been obliterated. The femoral artery seems to have escaped total erosion, because it was raised over the extravasated blood, and pressed close to the skin; but how could the profunda, the deep, muscular, and articular artery of the thigh escape, when the muscles themselves were disordered, the capsular ligament destroyed, the head of the thigh bone displaced, and all the bones carious? The injection of yellow water, of which Murray speaks slightly, as a doubtful experiment, is absolutely decisive; for though yellow water may be forced from the hypogastric artery through the natural anastomoses, into the femoral artery, yet, it will not pass through two successive series of anastomosing arteries. Where both the femoral artery in the groin, and the popliteal artery in the ham are tied, tepid water when injected has to work its way through successive sets of anastomoses, and exudes into the lower arteries very sparingly! But in this case, water thus injected, flowed easily into the arteries below the ham, while we perceive, by the experiment which I have quoted below, with how much difficulty the injected water finds this passage in the natural state of the arteries, and how wide the difference is betwixt the condition of an aneurismal limb and of a sound one.

Murray's difficulties are answered in one word: Not this yellow injection only, but the blood itself, actually moved through the anastomosing arteries; the man lived several weeks after the artery had burst*!

* Guattani does not mark the difference betwixt his experiment and his dissection; but his experiment was this: First, he placed his injecting tube above the hypogastric artery, then he tied the femoral artery in the groin, and threw in his injection, and it went round easily into the profunda femoris; which he explains by saying, "More satis copioso perfluxit." Next, he made another ligature upon the great artery in the ham, imitating the obstruction in this case of aneurism, and he forced the injection round in a second

This is the most singular fact in the whole pathology of aneurisms; for the blood which had nourished this limb had moved not only through the common inosculation round the hip joint, but it had gone by the most circuitous course. To finish its circle, the blood must have passed through three series of inosculating vessels, thus! the blood came not from the upper inosculations of the profunda into the trunk of the profunda, and so round the haunch by a short circle, into the great artery of the thigh, but must have proceeded first through the sciatic, thyroid, and other arteries of the pelvis, into the articular arteries of the hip; then from the articular arteries of the hip into the profunda, which is their parent trunk; then it must have gone down from the main trunk of the profunda along those lower branches of the profunda, which are named its perforating arteries; then, from these, the lower extremities of the profunda, it had passed into the articular arteries of the knee, and by this last inosculation the blood once more had access to the trunk, viz. to the popliteal artery, where it divides into the three arteries for the leg. In short, it had happened in this case, as must always happen in such cases, that the smaller arteries of the whole thigh, were remarkably enlarged; and that especially the arteries which pass round the hip were both so much increased in size as to be able to carry along a sufficient quantity of blood for nourishing the thigh; and that their inosculating extremities also were enlarged in like proportion, so as to transmit a sufficient quantity of blood for nourishing the leg. The blood had passed along by those vessels which lie upon the back part of the thigh, leaving the proper femoral artery dry of blood, and almost closed all the way from the groin, or rather from within the pelvis, down to the ham: I call upon Murray, with all his knowledge of the blood-vessels (and no

inosculation circle, viz. by the articular arteries of the knee, where of course the injection was a little retarded, but still flowed out, "*liquorem sane effluere conspexi*" but infinitely less easily, "*sed longe lentius, parciusque.*"

"Beneficio vincturæ in iliaca exteriori factæ, ac beneficio aquæ calidæ luteo infectæ colore, siphoneque in internam iliacam impulsæ, satis idoneum ad nutriendum articulum sine ullo iliacæ exterioris auxilio ego jam circuitum inveneram. Luteam enim impulsam aquam prodire videram ex arteriis, perreptantibus articulum pedis, quem ipse nuper abstuleram. Verum popliteæ hujusce arteriæ angustatio me impulit ad aliud instituendum experimentum, quod me doceret, utrum, iliaca exteriori, simulque poplitea vinculo adstrictis, impulsoque in iliacam internam liquore, hic per dissectas jam memoratas arterias exitum æque sibi inveniret, ac fieri videram, dum exterior tantum iliaca ligata esset. Prius igitur hanc solum vinxî, injectusque liquor de more satis copiose profluxit; poplitea deinde quoque revincta, liquorem sane effluere conspexi, sed longe lentius, parciusque."

other man knows so much about them), to point out any other passage for that blood by which the limb continued to live.

It is not from the want of every other kind of proof that I here press the argument so strongly. I do so only that I may impress it upon your minds, while I have many cases in reserve, more decisive perhaps than this. In that case which I lately mentioned, where a shoemaker having dropped his paring knife, struck it with the one knee against the other, so as to drive the point fairly into the femoral artery, Heister performed the cure, not by ligature but by compression. He laid a long train of compresses over the whole course of the femoral artery, from the wounded part up to the groin. Now, when Heister bound those compresses with the tightest rollers, drawn with all his strength! when he continued for three weeks a compression which commanded the hæmorrhagy, and stopped the motion of the femoral artery, what did he do? Is it to be believed that those firm compresses merely suppressed the more violent action of the artery, and kept its wounded lips in contact with each other till they adhered and healed? Surely not! He kept not the lips only of the wounded artery, but its sides, in perfect contact. When he thus closed the canal of the artery, the force of the circulation would fall upon the inosculating arteries. They would soon enlarge to such a size as to carry freely all the necessary blood. The circulating blood would no longer seek the main artery, which, being a contractile artery, would close in all its extent, and would adhere at all those points where it was particularly compressed. Heister's cure by compression, would resemble in all essential points the cure by ligature; in this only it would differ, that besides being tedious, painful, uncertain, the cure by compression would obliterate both trunk and branch; for since the profunda lies directly behind the femoral artery betwixt the compress and the bone (against which the artery is compressed), the compresses would obliterate the profunda, as well as the femoral artery, leaving nothing to support the limb, but that series of inosculating arteries running along the back part of the thigh; the value of which I have just explained. In short, the profunda lying so directly behind the femoral artery, as to be taken up by Gooch in the same ligature, may very reasonably be supposed to be affected by the broad compress which, in this case of Heister's, covered the whole tract of femoral artery.

But there is also another phenomenon in diseases of the femoral arteries, which is very interesting, and which proves this point completely; for independently of operations by ligature or compression, we have evidence in the natural cures (as

sometimes nature herself performs the cure), that the profunda may be cut off, together with the femoral artery, and yet the limb may be preserved. We see, for example, a great aneurismal tumor of the groin increasing rapidly till the skin threaten to fall into gangrene, and we wait in great anxiety and fear for that last change, in which the skin is to burst, and the patient to expire with one sudden gush of blood. The fever begins, the pulsation of the tumor ceases, the skin becomes livid, the whole limb is cold and without pulse, every thing seems to foretel an instant gangrene. But these which are so often the mortal signs of gangrene in the whole limb, are sometimes rather the presages of a happy cure; for either the clotted blood has so accumulated, or (in the natural aneurism) the looser coagula have so fallen down from the walls of the aneurismal bag into the main channel of the artery, as to stop the circulation from the groin downwards, in both the profunda and the femoral artery. Such obstructions turn aside the current of the circulation, new channels are found for the blood, and as it begins to flow more freely in these, the pulse, the heat, the feeling of the limb, are all gradually restored, they are perfect in a few days; the patient awakens from the low delirium which accompanied the first alarming signs; not only his life is safe, but in a little while, his limb also is perfectly restored.

Nay, it has really happened, that very nearly the same process has performed the cure, with this surprising variety, that during this natural cure, the tumor bursting, has laid the limb so open, that the surgeon has (if we may be allowed the expression) been able to look into the limb, and see how its vessels were affected.

* Petrus Antonius Ferrari, a cook, a man of about forty years of age, died of a very singular aneurism of the thigh. His body was dissected by Petro Javina, a

* "Quinto idus Octobris 1765, in Sancti Spiritus Nosocomio lecto accipiebatur Petrus Antonius Ferrari coquus, quadragesimum ætatis annum agens, qui cum prima vice a me sequenti mane inviseretur, inventus est cacochymo corporis habitu præditus, continua, lentaque detentus febris, legitimoque aneurysmate, pugni, grandioris nempe manus magnitudinem exedente laborans, quod trimestri ab hinc spatio in sinistro inguine originem nanciscebatur suam, et sursum, ac deorsum, abdomen scilicet, coxamque versus, nonnihil extendebatur.

"Tumor, qui aderat tunc temporis, aliquomodo esse circumscriptus, ac vehementer pulsare cernebatur; continuis doloribus, præsertim vero sub noctem acerbioribus, Ægrum afficere consueverat, ex quo causam percunctanti mihi, externam fuisse quum accepissem nullam, venerea ex labe omnimode derivandam esse, ex multis cicatricibus innotuit.

"Sanguis missus, et spongia, ex egelida posca expressa, tumori imposita, doloris etsi quandoque lenirent

celebrated surgeon in Rome. The history of his disease is as follows: "When I first saw him (says Javina) on the 11th of October, he appeared of an unhealthy habit of body, and was laid in the hospital of the Holy Ghost, with a true aneurism of the groin, as big as the fist. It had begun about three weeks before, and was now greatly extended, both upwards towards the belly, and downwards towards the hip. The tumor was circumscribed, beating violently, and very painful, especially during the night; and finding that it had arisen from no external cause, I ascribed it, says Javina, to the venereal disease, of which I observed many scars."

"Having bled the patient, and applied a sponge soaked in cold solution, the pain was slightly abated, but soon returned with a strong pulsation in the tumor. The tumor increased daily in magnitude; the pain, notwithstanding, and the pulsation, became lighter; and on the 19th of October, the pain and pulsation suddenly and entirely ceased, with a sense of bursting within, a sudden flattening of the tumor, and an extension of it half way down the hip." Thus is the day and hour of the bursting of this aneurism correctly marked, and the consequences of that bursting are next to be observed. "The œdema, which

acerbitatem, vehementius tamen paulo post pulsatio, et dolor augebantur; sed hæc, postquam major in dies tumor factus in magnam excreverat molem, leviora fieri cœperunt, atque tertio decimo tandem kalendas Novembris magna cum tumoris depressione, nec non per internum plusquam dimidiæ coxæ latus propagatione, levi prægresso fragore, evanuerunt.

"Verum exinde *œdema*, quo leviter antea pes tantum afficiebatur extremus, cum caloris, sensus, motusque deperditione sic excreverat, ut universi pedis hujusce vita in apertum discrimen veniret. Continuo idcirco linteum quadruplex, ex vini spiritu cum camphora expressum, imponi calide, et quam sæpiissime curavi, quo quidem præsidii genere, quadraginta horarum spatio, pars in integrum pene, *œdema* valde imminuto, restituebatur.

"Interim tamen in gangrænosa tubera sub inguine elevabatur tumor, quæ pridie kalendas Novembris sub lucem disrumpebantur, cùmque fœtentium humorum colluvie inquinatum summo mane ægrotum invenissem, discissis, remotisque fasciis, ac spleniis, quæ ante dies octo, quam hæc acciderent, parti applicaveram, quo essent impedimento, ne ex inopinato, tenuissima tumoris perrupta cute, exanguis fieret, magna inde nigerimi sanguinis copia, partim in grumos concreti, partimque in fœtidam saniem dissoluti per fatiscientia tubera, coccinei vero (quod maxime, ne fieret, verebar) ne guttula quidem effluente, effundebatur.

"Quare *Ægro* obfusa illuvie depurgato, plagam linamentis quam mollissime impleri, et linteis ex egelida posca, quolibet altero die circumducta fascia, velari curabam, atque per hæc, velamenta communia, nec non aneurismaticus faccus, cum annexis vasis, nervis, membranisque, quæ ab inguine ad mediam usque coxam, et ultra computruerant, octidui spatio, quod sponte absque distractione fieri sinebam, abscesserunt. Hinc factum est, musculis, pectineo, iliaco, atque psoas parte infera, sartorio, anteriori denique tricipitis portione, denudatis, et a putredine vindicatis, triangularem alveum, postremis hisce geminis præcipue interclusum, ab

had hitherto been limited to the foot, now spread so rapidly, and with such entire loss of heat, feeling, and motion in the whole limb, as plainly to indicate approaching gangrene." "But by the continual and careful application of cloths soaked in camphorated spirits, the limb was, in the course of forty hours, almost entirely recovered from this condition, with a manifest reduction of the œdema." "Meanwhile the tumor rose higher and higher, with a livid and gangrenous bulging, which burst at day-break on the morning of the 31st of October." In the morning, Javina found his patient swimming in fetid ichor. He immediately cut away the bandages, which had for eight days been applied by way of precaution, lest the patient should die of hæmorrhagy from the bursting of the weakened integuments. There was discharged from this crater a profusion of black and fetid blood, partly grumous, partly dissolved into a fetid serum; but of fresh and florid blood, which I greatly feared," says Javina, "not one drop flowed."

"He then cleaned the patient of this filth, filled the basin of the aneurism with the softest lint, rolled the limb gently with a bandage which was renewed every second day, covered the whole with pledgits wrung out of a cold solution, and suffered the dressings to remain for eight days till they loosened of their own accord, the

inguinis ligamento ad sedem usque, qua decussatim implicantur, vasis, nervisque cruralibus in eodem alveo excurrentibus, a putredine penitus destructis, expoliatum, rubentemque apparuisse.

"Cum eo loci res esset adducta, tibi, vir clarissime, qui sponte ad ægrum invisendum, rei novitate motus, accessisti, non sine admiratione inspicere datum fuit.

"Quo vero sordibus evacuetur abdomen, in externum ulcus continue dilabentibus, scalpellum, ductore indice sinistræ manus digito, per hiatum, qui tunc sub ligamento inguinali patens erat, indebam, cujus ope ligamentum hoc, abdominis musculos, nec non vilamenta communia, lata satis discindebam plaga, sicque internum aneurismaticum cavum in apertum ponere, densioribus sordibus expurgare, eidemque cavitati feliciter adeo medicinam, quæ omnis in linteo carpto constiterat, mihi facere contigerat, ut cicatrix cum proximæ valetudinis spe prosperæ quaquaversum duceretur.

"Attamen attenuatus æger, valentissimis licet jusculis aleretur, macie magis magisque conficiebatur, sic ut quinto tandem kalendas Decembris marasmo absumptus fuerit.

"Referato die crastina cadaveris abdomine, viscera omnia secundum naturam, si glandulas mesenterii, lymphaticasque nonnullas circa lumbos, mole nonnihil, ac duritie auctas, exceperis, reperta sunt. Arteriam vero iliacam communem sinistram, quam peritoneo exuebam, cum eo usque diffidissem, ubi in iliacas minores dispertitur geminas, externam scilicet, internamque, quæ et hypogastrica nuncupatur; iliacæ externæ osculum (arteria pervia manente hypogastrica) durissimo, conoideoque operculo sex fere lineas longo ex lymphæ concreta, cui archetypo fuerat, quin parietibus adhæresceret vasis, efformato obturari cernebam, quo sublato, inditoque in conicum archetypum hunc specillo tenuissimo, arteriam vix penetrabilem esse adnotabam. Quare hanc velamentorum, musculorumque abdominis discissionem in aneurysmatis cavitatem usque,

muscles, nerves, and arteries, and the skin itself, having run into absolute gangrene from the groin to the middle of the hip." "Then were seen the pectineus, the iliacus, the lower part of the psoas, the sartorius, and the fore part of the triceps, cleared of the sloughs, red and granulating, and forming an empty space, a sort of triangular cavity, extending from the femoral ligament to the crossing of the triceps and sartorius muscles, where the femoral artery perforates the thigh; the crural nerves and vessels, which should have occupied the hollow, being entirely destroyed by the gangrene."

"It was necessary to empty the internal abscess of that fetid ichor, which was continually draining down upon the sore, I passed my fore-finger," says Javina, "under the ligament of the thigh, which was then open, and, by the guidance of my finger, I cut the ligament, the abdominal muscles, and the skin itself, with an incision of no small extent; and thus having opened the deepest part of the sac, cleared it of the thick and foul matter, and dressed it with fine lint. The cicatrix advanced most prosperously on all sides with every prospect of recovery; but, notwithstanding my utmost care with soups, and every thing nourishing to support the patient's strength, he sunk daily, and died on the 27th of November."

"Upon opening the abdomen, every thing was found there except an enlargement and hardness of some of the mesenteric glands:" But when the common iliac artery was dissected from the peritoneum which covers it, and slit open down to its division into the external and internal iliac arteries, the internal iliac, or hypogastric artery, was found pervious, while the external iliac was found closed with a plug of coagulated lymph, very hard and firm, of a conical form, and half an inch in length; the plug had been moulded into this conical form by the mouth of

(peritoneum scilicet inter, et musculos psoas, atque iliacum internum, a quibus, sanguine ex perrupto tandem aneurismatis sacco in cellulosa ejusdem peritonei epiphisim erumpente, divellebatur) profectus sum, sicque amplius duos pollicis ab ima operculi sede detruncatam, sub eoque crassiore quadruplo, ovalis figuræ, et ligamenti adinstar duram, atque imperviam, cujus extremo lacinia, discerptis veluti sacci frustulis, suspendebantur, psoas musculo adhærere advertēbam.

"Arteriæ iliacæ ovalem hanc partem polyposa substantia variæ densitatis adeo infarctam esse discindendo adnotabam, ut tunicarum ejusdem forma penitus destructa, in uniformem massam spongiæ cera imbutæ similem, transformata videretur.

"Ossa ilei, atque pubis eo loci, ubi arteria iliaca externa ex abdomine in cruralem abitura egreditur, ibidemque in inguine, ubi aneurysma ortum habuit, profunda adeo obsidebatur carie, ut choroidea cavitate nigrities late, apprimeque retegeretur.

"Cruralis denique arteriæ caput inferius tenui, ac fimbriata extremitate a sartorio musculo, cui nonnihil adhærebat, circa medium coxæ, nullo interposito sanguinis coagule, cogeatur."

the artery; the plug being withdrawn, and the probe introduced, the artery was found to be almost entirely closed." "The sac of this aneurism was formed by the peritoneum, which was torn from the face of the internal iliac and psoas muscles, by the ruptured artery driving its blood into the cellular substance of that membrane." "The dissection of the skin, muscles, and of this aneurismal sac, being continued downwards; and the artery cut across about two inches below the point of this plug, it was found enlarged to four times its natural diameter, of an oval figure, hard as a ligament, impervious, and terminated at its lower end in rags and fringes of the aneurismal sac." "This oval part of the artery was so choked with a sort of polypous substance of various consistence, that the arterial coats were confounded and destroyed, the whole being converted into a mass resembling a sponge dipped in wax." "The bones of the pelvis, too, where the iliac artery turns over the groin, and comes out into the thigh, and especially in the groin where the aneurism began, were thoroughly carious and black." "The lower end of the femoral artery was closed (without any plug of blood) by a fringed extremity of the sartorius muscle, to which it adhered slightly."

I could not, without this detail of all the circumstances, venture to reason upon the case. We perceive, that in such aneurisms the force of pulsation becomes irresistible in the progress of the disease; if the aneurism burst before the arteries are all obliterated, the patient dies, in a few pulsations, of the heart, so profuse and sudden is the loss of blood; but, if he escape this first danger, he may, though the arteries are obliterated, survive even for months (for this patient lay three months in the Hospital) and yet in the end die exhausted. The progress of this extraordinary aneurism is so distinctly marked from stage to stage, that we cannot but take a lively interest in the case. First, The aneurism burst; the blood was diffused among the cellular substance; the tumor flattened; the pain of distention ceased; the blood was no longer conveyed along the artery; the limb became cold, benumbed, motionless; and thus the patient lay for forty hours betwixt life and death. Secondly, The artery was at this time completely obstructed, and the limb turgid, and in imminent danger of gangrene; but the heat and feeling of the limb returned, and the lessening of the swelling showed that the vessels had renewed their action, and that nature had found out new channels for the blood.

Thirdly, The bursting of the tumor was not owing to the increasing impulse of the blood, for the artery had ceased to convey blood, its canal was obliterated; but the cellular substance was crammed with extravasated blood, the fore part of

the limb was without circulation, the skin distended to actual gangrene, the tumor burst in consequence of that gangrenous suppuration which is inseparable from this degree of distention, and when it burst, the old and coagulated blood, or putrid serum, showed the condition of the parts; not one drop of blood flowed, which proved the obliteration of the great arteries on the fore part of the limb. Javina feared this period, viz. the bursting of the tumor, he seems to have been for some time in fear of the artery throwing out its blood; but had he observed the coldness, the numbness, and the loss of pulsation which must have accompanied this state of the limb, he might have suspected the total obliteration of all its great arteries.

Fourthly, This conclusion is common to Javina's case, and to other great aneurisms, that while an aneurism increases in size it becomes irresistible, and the parts cannot long endure the violence of its pulsation. But pressure and resistance are mutual! the skin cannot be affected outwardly without the parts within being destroyed; what destroys the muscles will destroy the arteries; and thus the pressure within may be such as obliterate the artery before the bursting of the skin. If the aneurismal sac burst within before the external parts give way, the safety of the limb is almost ensured, for no blood moves along that artery; every thing is prepared for the final change; the blood finds new channels the moment the aneurism bursts, and the limb is absolutely safe; we have only to cleanse the sac, to support the strength, and to save the patient from the profuse evacuations necessarily flowing from this extensive gangrenous sac.

Fifthly, The main proposition which I meant to establish is here fully proved; there is no want of injections of yellow water to explain what had happened in this case. The aneurismal sac burst only after the obliteration of the arteries; then the skin gave way; the parts which had been injected with extravasated blood fell successively into gangrene; the sac cleansed and suppurated; the sartorius, pectinalis, psoas, and triceps muscles, were freed from their sloughs, and assumed a florid and healthy hue; the bed of cellular substance, in which lie the great vessels and nerves, was quite empty, from the ligament of the groin where the artery first enters the thigh, down to the tendon of the triceps, where the same artery passes into the ham. The cellular substance, arteries, veins, and nerves, were quite destroyed: The emptiness of this triangular hollow demonstrates, that all the great vessels were obliterated: The red granulated flourishing condition of the whole wound shows, that the limb was effectually supported by other arteries.

This case demonstrates that the great arteries of the thigh itself may be destroy-

ed, not only without that gangrene which timid surgeons have foretold, but with such vigorous circulation remaining in the limb, as to enable the ulcer to throw off its sloughs like a gun-shot wound, and assume a healthy and granulating appearance, to heal rapidly, though too slowly (as in this case), for the patient's exhausted strength.

Morgagni * puts the following question, "How, after that remarkable cure by Marcus Aurelius Severinus, could the crural artery, when putrified, dissolved, and broken down near to the groin; how could it, by the force of fire applied thereto, so recover its parietes, that the limb not only continued to live, but the man could even walk upright upon it with the small support of a low and slender cane?" This question is already resolved: The artery did not recover its parietes, nor revive after being putrified and dissolved! but the branches of the profunda, which lie along the back part of the limb, were enlarged, and substituted in its place. I will relate the case to you with all those circumstances which seemed so wonderful to Severinus himself, and so inexplicable to Morgagni, but which you will easily understand., you will find in the following narrative old manners and antique surgery, but a case in all respects interesting and well related.

"I was called, says Severinus, to R. D. Anselmus Paganus, a nobleman, who had a tumor in the upper part of his thigh near the groin: he had been attended during four months by many physicians; the case growing daily worse, for the tumor at first, no bigger than a filbert, beating strongly so as to move the bed-clothes, grew to such a size, that it lost its pulsation, and waxed as large as a winter gourd, with an unequal surface, marked with three prominent bumps."

"When the tumor was advancing towards its last stage, the pulsation was not only manifest to the hand, but was perceptible to the eye; it was not a partial nor slight pulsation, but a big throbbing of the whole tumor; it was terrible to the patient, who felt at each pulsation like the grating of a saw cutting and tearing across the nerves and tendons. His attendants feared lest he should expire under the tortures of this pulsating pain. He had the Hippocratic face, the attendants were watching his expiring breath, and the priests and the pious friends were speaking to him of the life to come. Night and day the bed clothes were raised by the strong pulsations of the tumor, as if by the thumping of a hand. The physicians of the city all were at a loss, some prescribing one thing, some another. One ordered compres-

* Vide Alexander's Morgagni, p. 42.

ses with plates of lead ; another, a consecrated plaster ; another, astringent embrocations : One ordered the application of a ram's hide, and such things as were commonly esteemed useful in hernia : another ordered the application of snow and ice ; but one and all of them betook themselves away as they conveniently could : One sneaked off, another could not stay : another was in haste : one scarcely staid to hear the story with decency, while another prognosticated immediate death : some retired impressed with the horrors of the man's situation, and not indifferent to their own character : most of them gave him over to the upholsterers and sextons : one celebrated physician, very celebrated when called to prescribe, prescribed only extreme unction *." By this part of the narrative, Severinus designed to show to what a dangerous condition this poor man had arrived, and how wrong it is to pronounce a harsh sentence, even in the most desperate cases. Here he describes the scene which had passed before he was called ; but the condition of the patient when he first visited him was as follows : " He found the tumor running rapidly into gangrene, livid, covered with vesications, and the livor extended to the toe. The limb was quite insensible ; he had wakeful nights, and horrid dreams ; the eyes were, as in a coma, heavy and loaded ; he had continual fever, with turbid urine ; delirium at times, and great failing of strength ; the limb lay out motionless, but with terrible pain of the knee, shin, and foot ; he could not move it, and cried continually to his friends to change the posture of the leg, which gave him some slight relief.

Severinus having exhonoured himself by giving the prognostic natural in such a case, applied an astringent in place of a relaxing poultice, and matters seem from this period to have taken a very sudden and happy turn ; for in a very short time the livor of the tumor disappeared, a small part only in the centre of it remained insensible, and by the operation of a powerful antimonial both upwards and down-

* " Denique quod sit summum omnium, et confirmatio plenissima, atque certissima ; medici ex universa urbe præcipui, atque indices lectissimi, ad consultationes acciti ; hi quidem plumbeas deligationes, cum plumbea lamella ; hi comitisæ inscriptum ceratum varignanæ ; hi embrochas adstringentes ; hi emplastra de pelle arietina, aliaque ad ramices et hernias celebria ; hi denique adusque nivis nicolai præcepto necessario usum dicebant compulsum ; administrarunt. Istorum vero omnium hi continenter abscedere ; hi quam citissime sese expedire ; hi vix audire et parumper consistere ; hi cum protestatione mortis certissimæ consultare ; hi refugere ab horrore et calumniæ periculo ; hi vespillonibus hominem et libitinæ devovere cœperunt. Fuit et famigeratissimus hercle medicus, qui, viso statim casu, piamen crucis, ut sit pro luce perpetua, tantum ægro prætulit. Ita rem summe extremam certo crederent omnes ; ita nil quidem fuit certius aneurismate."

wards, he was relieved from all his worst symptoms, and restored to ease, rest, and sleep; the leucophlegmatic swelling, extending from the tumor to the foot, was discolled from time to time by the occasional application of astringent fomentations.

Then the opening up and sloughing of the tumor began, or the necrosis, as the ancients called it, i. e. the gangrene, death, and separation of the injured parts. "In three days," says Severinus, "after those changes which I have just described, nature began to throw off that insensible part which remained in the centre of the tumor; upon observing which, I cauterized that central part with red hot irons, and repeated this cauterizing, morning and evening, for five days. The great slough being removed, there appeared under it a fleshy-like membrane, perforated at various points, and beneath it the tumor or sac itself full of black and grumous blood: Now Severinus cauterized with very broad and flat irons, applied one above another; he repeated the same next day; in the evening he drew out a full pound of coagulated blood, and in the night some ill-smelling blood issued from the opening.

Next day he cauterized all over the surface, plunging the iron, hissing among the stuff, as into water; he now used four large and flat cauterizing irons; and in the evening, upon lifting up the poultice, he took out, with a large spoon, fully two pounds of blood: Next day he plunged in the irons again, and raked out the blood, which now had a horribly offensive smell, growing daily worse; and in cauterizing in the evening, he extracted again, with his spoon, two pounds and a half of this putrid and grumous blood.

He now began to put into this great cavity astringent powders of alum, sal-ammoniac, and some iron preparations, and laid over all cloths, with unguentum Egyptiacum, having first thrust in tents spread with it. In this manner was the aneurismal cavity dressed every six hours, extracting at each time great quantities of corrupted and very fetid blood; and some days after this kind of dressing was begun, he tore out, with his forceps, a piece of spongy looking flesh (probably a firmer coagulum of blood) of about a pound weight, from which time he continued the same medicines, but used them more sparingly.

When in a little time this flux of putrid blood had ceased, and nothing remained except putrid flesh, that is, the canals of the veins and arteries, and the fibres of the putrid muscles and tendons causing an intolerable fetor, having extracted a part of this putrid stuff, and finding less of it next day, he began to use a mundificative, the wound having been first washed with wine, spirits, salt, and honey (an

odd composition, but powerful enough if used strong), a putrid nerve of three inches long (half a palm) having been extracted, the wound was tolerably clear; thus the mundificative was applied, and next day the whole wound seemed purged and clear, and the bone lay bare about an inch in breadth, and three inches (half a palm) in length.

Severinus then took a reed, and blew in catagmatic powders upon the bone, and over the whole surface of the cavity; the hollow or basin of the aneurism was of such size, as to require no less than half a pound of lint to each dressing to stuff it with. He dressed the bone particularly with the catagmatic powder, and moistened with spirits of wine all the naked part of the bone; he laid over all, an ointment made with gum elemi, and he washed the general surface frequently with Aqua Gurgitelli; and he very seriously attributes the blackening of the bone, its total exfoliation, the rising up of the granulations, the generation of flesh, and whatever good pus was poured out, all to his Aqua Gurgitelli and catagmatic powders, as if the man had not been alive, and nature working in his limb to more purpose than the physician. The quantity of serum discharged was so great as to require dressing twice a day; at one time the running was so great, that they were obliged, besides the lint, to use sponges to suck up the moisture, and the limb downwards from the knee to the ankle was greatly pained and convulsed, for which it was rubbed with turpentine, oil of wax, and cock's grease: But the cure advanced, flesh was granulated, the bone was covered with granulations, though sometimes the parts looked so ill, and the matter was so profuse, that they needed to dress thrice a day. How Severinus continued to dress the bone, and assist the granulation, it were tedious and useless to relate; it is sufficient to observe, that the cure was going on from January, the time of the gangrene, to the end of August; that the flesh of the groin filled up perfectly; that the patient walked well and firmly, sometimes using a short stick, but sometimes also walking well without one."

This is a singular case, and a very tedious cure; but it is not because the history of the disease is related with many touching circumstances that we read of it with interest; this phenomenon of the obliteration of the great artery of a limb is one of the most extraordinary in the economy of the human body, and is always attended with circumstances which must interest us in the fate of the patient so near death! so miraculously restored.

The rivals of Severinus accused him of curing so desperate a case only by

witchcraft and enchantment; but if there was any thing of this kind in the cure, says Severinus, it was only the miraculous power of fire *. Severinus himself, ignorant of pathology, ascribed every thing fortunate in this case to the power of fire and his catagmatics. He believed, like Morgagni, that the artery survived amidst this wide destruction of parts, and, like Morgagni, was astonished at his own success.

This case adds one more proof to those which I have taught you. When the pulse ceases the artery is oppressed; while the artery is oppressed by its own aneurism, the inosculations are enlarging; every thing is prepared by nature for the ultimate change! The main artery is obliterated, the inosculations nourish the limb; the aneurism may burst, but the patient cannot bleed to death. When the parts gangrene down to the bone, and the bone itself is exposed, black and carious for three inches in length! when a nerve, as Severinus calls it, some inches long, is hooked away with the other sloughs! when the great crater of such an aneurism is dressed to the bottom to the very bone for seven months! we need not inquire how the artery has reunited so as to perform its functions. Such artery is destroyed, and the inosculating branches of the profunda perform its office! Nature has saved the patient from the bursting of the aneurism, and the limb from the destruction of its artery, the chief difficulty of the physician is to save the patient from the wasting which accompanies such an extensive sore, whose surfaces, external as well as internal, are all gangrenous, and slough like a great gun-shot wound †.

* "Porro quod incantamento, vel ope magica, tam insuperabile malum superaverimus (ut quidam nostris ex æmulis dixerunt) tum ridiculum, tum invidentiæ ore projectum, apparet: incantamenti certe vim, et magicam præstantiam, æmulatur et exaequat, rite recteque comparata, apte accommodata, et opportune administrata, vividi præsidii, manusque divinæ, vis, quod ignem appellamus, energia: hujus quanta sit virtus, amplitudo, et inter cuncta Medici adjumenta, majestas in opere pyrotechnia, fuse ac plene per nos est credo demonstratum."

† "Some years since, I was desired to give a visit to a man lying in my way to Whitehall. He had a large white tumor possessing the fore part of his right thigh, of a few months growth; it was soft from the first appearance, and observed by the patient to be bigger and lesser one time than another. I considered the swelling, and concluded it an aneurisma. That there was no pulsation to be felt in it, was because it lay deep among the muscles, in which case the pulse is frequently intercepted. There lay a gummy emplaster upon it, and an attempt had been made to open it by caustic; but it not penetrating deep enough, the eschar separated without reaching near the cavity. I declared to the patient my thoughts, viz. That the swelling proceeded from blood poured forth of its vessels, either by erosion from within, or by some outward cause,

But hitherto I have spoken only of natural cures, in which there is a slow distention of the artery, and a gradual dilatation of the inosculating branches, where the blood is worked slowly on from branch to branch, till many are enlarged, and much blood is conveyed by the collateral arteries before the main artery is choked up. But is it not still possible that, were the limb suddenly deprived of its main artery, gangrene might ensue? It shall next be my business to prove, that the artery being tied, and the blood suddenly intercepted, the limb will not fall into gangrene.

as by riding, &c. and advised him not to permit the tumor to be opened, desiring that, if his surgeon should persist in the suppurating or opening of it, he would send to me to meet him."

"Some few days after, the patient sent me notice that his surgeon had been with him, and resolved to open it; whereupon I took the next opportunity to speak with the surgeon, and went along with him to his patient; where I endeavoured to persuade him that the swelling arose from blood, and withal proposed a palliative cure by a laced trowze and some good restrictive. But the surgeon declared himself positively for the opening of it. I seeing his resolution, replied, Since you are so opinionated, you may (if you think good) make a trial of the tumor, by thrusting a small lancet directly into the middle of it; and if, upon pulling out of the lancet, it appear mattery, you may lay it more open; if it appear bloody, you may more easily cure it than one made by a caustic. He readily assented to the trial, and the patient rejoicing in the proposal, he attempted it with a lancet; but not thrusting it deep enough to reach the cavity, I took the lancet, and, passing it into the same opening he had made, thrust it directly down into the cavity, and pulled it out bloody, but not one drop followed it. The surgeon not being therewith satisfied, I wished him to pass a small probe down into the opening: He did so; and I also made a search with the same probe, and felt the cavity large and full of liquids, which was certainly blood, the probe coming out bloody. I persuaded the patient to keep his bed till that puncture should be agglutinated, and advised the surgeon to be careful in the cure of it. We dressed it with a pledget of Leniment. Arcaei, with emplaster and bandage: to the use of which medicine I left them, not doubting of their care in healing up so small a puncture. About ten days after, walking near the door in a dark evening, weary, and desirous to rest myself, the thoughts of this poor man inclined me to go into the house. I inquired of the landlady if he was within? she replied, He is dying: That upon the rising out of his bed, the blood had burst forth excessively: That the surgeon had for some days endeavoured to stop it, but had since left the patient, and a neighbouring woman had applied a poultice to it; and that the chamber stunk so extremely, as it would poison me to go into it. I went up, and found the room scattered with stinking bloody cloths, and the poor man languishing in his bed, which was not cleaner. I sent presently away for the surgeon, and in the mean while made rollers and compresses, and sent for some yeast and wheat flour. The surgeon being come, we spread a mixture of them upon cloths, and armed several tents with the same. Having thus prepared our dressings as the time would permit, we took off the bloody ones, and held the orifice clean, while we cleansed the thigh from the poultice and blood, then stopped the orifice with a tent proportionably, and applied our agglutinatives over, with compress and bandage wrung out of oxycrate. We rolled the member moderately strait, then laid him

" 'Thomas Morris, a seaman, twenty-four years of age *, one of the crew of the Fishguard, was wounded across the top of the thigh with a musket shot, in an engagement with the French frigate l'Immortalité. The wound was three inches in length ; it passed across the thigh, from within outwards, a little way below the edge of the crural ligament. He ran down to the cockpit, where his cries were so outrageous as to surprise the surgeon, who saw only a superficial wound, without even the usual degree of hæmorrhagy ; but it will presently appear that this excessive pain must have proceeded from the laceration of the anterior crural nerve, which lies on the fore part of the femoral artery, enclosed along with it in the same sheath."

" He was laid in Plymouth Hospital on the 4th day of his wound, (the 23d day of October 1798). The wound looked black and sphacelated ; the sloughing was already begun : On the 5th day the sloughs began to be thrown off ; and on the evening of that day, he, for the first time, lost blood to the amount of two pounds, but this hæmorrhagy ceased before the surgeon could be called. That night he passed in a very restless and agitated state ; and next day, the sixth from the time of the wound, at eleven o'clock in the morning, while one of the gentlemen was removing the dressings, the femoral artery itself burst, and threw its blood clean, and caused a mess of caudle to be given him, and encouraged him with hopes of recovery. The surgeon pleaded for himself that he thought the patient had been dead."

" Three or four days after we dressed him again, and found him much recruited in his spirits, he not having bled one drop ; and indeed the emplasters adhered as close to the skin as we could desire. After we had taken out the tent, abundance of grumous blood issued forth : we cleansed it away, and shook into the abscess about a drachm of Merc. Præcipitat. ; and though we had then choice of medicaments, yet we applied the same as before, and continued that method of dressings, till the blood was converted to matter. Then we slit open the orifice, and dressed it as a sinous ulcer. After some days, observing that the matter could not discharge while he kept his bed, till the abscess was full to run over, we caused him to rise out of it ; but that little while he was up he swooned ; wherefore we put him to bed again, and allowed him stronger nourishment, and by a seton needle made way for the discharge of matter to more advantage. The abscess being well disposed to cure, I left him again to his surgeon, who cured him."

" This experiment of opening aneurismas by puncture is not to be imitated, unless it be in such cases as this, where both patient and surgeon are so incredulous." WISEMAN, p. 23.

* This case is transmitted to me by Mr. Stephen Hammick junior, of Plymouth Hospital, as a confirmation of what I have said concerning these inoculations of the profunda in my former Book on Wounds ; and his letter is full of such flattering expressions as I cannot repeat, but I am not insensible of them, nor of the care with which Mr. Hammick has drawn out the case for my private use ; but such a debt is best transferred from myself to the public ; Mr. Hammick will be always known for his zeal in his profession.

with prodigious force; but he immediately thrust a compress into the wound, maintained it with a firm pressure, and so suppressed the bleeding."

"Mr. Hammick was sent for, who, being in the same building, very soon arrived to the patient's assistance; and the compress being a little raised, he laid hold, with his fore finger and thumb, of the upper part of the femoral artery; with the left hand he removed the clotted blood, dilated the outer edge of the wound, that he might strike the needle more freely; and then passed the needle under the artery; and with a firm ligature, tied in at once the artery, the vein, and the anterior crural nerve. They could not be separated from each other from the artery being ruptured so very high. He would also have applied a ligature below, but the disease extended downwards along the lower part of the artery: that intention was therefore forsaken, and a compress and roller being applied, the patient was laid to rest with an attendant watching by him day and night."

"A total deadness, as the man expressed it, with inability to move the limb, immediately ensued; and half an hour after, the heat of the limb being measured by Fahrenheit's thermometer, was found ten degrees lower than that of the sound limb. He slept, or rather dozed, during the whole afternoon, complaining but little; towards evening, about six o'clock, he said he could feel the diseased limb as well as ever, and he moved it into another posture without help; its natural heat returned; the temperature of both limbs was now equal, the pulse quick, and the symptoms moderate. This first night he passed tolerably well; he slept the greater part of it; but he was once, during the night, alarmed with a fearful dream, and awoke in great terror. The wounded leg was now rather warmer, the pulse very quick; he complained much of thirst: He was feverish during the whole of the following day; it was about nine in the evening that the fatal bleeding came on! at nine in the evening the hæmorrhagy first burst out, and he lost about two pounds of blood; it was soon suppressed by applying a compress, and it was observed that the ligature of the femoral artery was perfectly secure, the blood had come only from the lower part of the wound: the man was greatly exhausted by this hæmorrhagy, and in such cases the slightest return of bleeding is fatal; next morning a slight hæmorrhage appeared, and he expired about eight o'clock, viz. forty-five hours after the bursting of the femoral artery."

"Mr. Hammick was not permitted to inject the limb, but he dissected it with particular care. He found his ligature perfectly secure; it was placed close to the ligament of the thigh. The artery below this was in a sloughy condition, quite

sphacelated ; its walls full of holes ; and this state of the artery extended from the groin, where the ligature was applied, a great way down the femoral artery ; it began about the 8th of an inch below the ligature, and continued three inches beyond the point where the profunda goes off. The upper part of the profunda, and the orifices of the two circumflex arteries, were diseased ; much coagulated blood lay behind the arteries, filling the interstices of the muscles. The anterior crural nerve was enclosed in the ligature, and some of its fibres were transfixed by the point of the needle, and divided."

All the steps of that process, which I have represented to you, are well marked in this case. This is an example of the secondary hæmorrhagy peculiar to gun-shot wounds. The ball had not cut nor wounded the femoral artery, but grazed it. The ball had passed close upon the artery ; it had even torn the sheath in which the artery is enclosed ; the extreme and frantic pain which this man suffered can be accounted for only by the wounding of the anterior crural nerve, and that nerve lies along by the artery enclosed in the same sheath with it. When the sloughing, or, in other terms, the gangrene of the wound began, the vein first gave way, and there was a slight bleeding, easily suppressed by a compress. When the deeper sloughs fell off, the artery itself next gave way, with an impetuous gush of blood. When the artery was fairly surrounded with the ligature, and its blood suddenly intercepted, the deadness and coldness (so perceptible in less than half an hour) showed how few of the arteries of the limb were then in an active state, how sudden the effect of the ligature was. When the heat, sensibility, and motion of the limb returned, and the temperature of this limb rose above that of the sound one, it was demonstrated that the whole vessels of the limb were then excited to strong action to supply the loss of the femoral artery. The circulation was re-established all at once, just as in our injection the fluid goes round, by one stroke of the syringe, from the arteries of the pelvis to those of the thigh. And, finally, The return of the blood by the lower part of the artery, while the upper part was secure by the ligature, demonstrates that kind of circulation which is already sufficiently explained. It was this secondary hæmorrhagy from the lower part of the artery that was fatal ; the blood had come down through the sciadic and thyroid arteries, had poured into the profunda, and had welled out through the cribrous or sieve-like part of the sloughing artery. To have saved this man's life, then, the blood must have been opposed at this point, and forced to pass through still ano-

ther circle of inosculating arteries. In place of being allowed to enter the profunda, or femoral artery, it should have been forced on through a second set of inosculations till it reached the main artery by the small articular branches of the ham. Mr. Hammick has the politeness to ask, What should have been done? To have cut downwards to the found part of the artery would have served no good end! Ligature in such a case was impossible! Ligature, in any case of hæmorrhagy, from sloughing or gangrenous arteries, is not to be trusted; for sloughing opens various passages for the blood, which no single ligature can command.

Had an injection been thrown into this limb after death, it would only have spoiled the dissection, for it would have exuded through many arterial mouths; not only from the criblous part of the sloughing artery, from the profunda, and from the circumflex arteries of the joint, but from every small inosculating twig that opened upon the inner surface of this gangrenous sac. Perhaps this sac should have been filled with dry and firm sponges, and the limb rolled from the toes upwards with a firm bandage. Pressure and the sponge are, I apprehend, sufficient to oppose every secondary hæmorrhagy proceeding from inosculating arteries and reflux blood. Pressure would have been sufficient, perhaps, to turn the blood still farther round into more distant channels; a sponge and pressure are alone fit to oppose hæmorrhagy from a broad and gangrenous surface.

But, in justice to this interesting subject, I must lay before you one case more, which I am induced to do for two reasons; in the first place, the case is perfect, the patient having lived; and, in the next place, I have but to present the case to you in a fair translation, the chief accidents of it are already explained; and if you reason for yourselves, as I have argued on the other cases, you will find it clearly proved, that in the following operation (which was performed by the celebrated Guattani), not only the profunda was compressed along with the femoral artery, but the external iliac was so compressed also at the passage from under Poupart's ligament, that every artery on the fore part of the thigh was stopped.

"A goldsmith of the name of Morellus, fifty-five years of age, consulted Guattani about opening a tumor in the groin, which all the other surgeons declared had come to a perfect suppuration. Morellus had, during the whole winter, complained of a settled pain in the right groin, sometimes milder, sometimes very violent, but never absent; accompanied, during the winter only,

with a degree of lameness, but now in the spring it had begun to swell. When this unlucky Morellus, going along with others on the 4th of June to St. Peter's, to see the pompous ceremony of the consecration of the host, was seized suddenly with such dreadful pain, that he was obliged to go home, and partly from fear, partly from the violence of the pain, went to bed and lay for three months under the care of his physicians, their prescriptions all ineffectual, his disease increasing daily. The unfortunate Morellus, now almost hectic, was entirely confined to bed; there was great swelling of the groin, contraction of the thigh, (so that he could not stretch it out), and a distinct fluctuation in the groin, which extended from the symphysis pubis to the spine of the ilium, but still without tension or pain; on the contrary, the fluid fluctuated freely, and seemed to be immediately under the skin."

"Guattani could not allow himself to believe this to be a proper suppuration, because the fluctuation brought no relief; and, though there was no pulsation, he yet suspected aneurism, and explaining himself on this head to the consulting physician and surgeon, Amicio and Maximinus, both professors in Rome. They agreed to spend a few days longer in trying common remedies, partly that they might make a trial of such remedies as might be thought advisable, but chiefly to allow time for Guattani to make up his mind concerning the nature of this disease."

"After fifteen days, they found no change, except a new suppuration within four fingers breadth of the great trochanter, and therefore resolved to do the operation, and to cut into the groin at the place the most favourable for stopping the flux of blood, in case of Guattani's fears about aneurism being well founded. But lest the assistants or friends, and more especially the patient himself, should be alarmed with the sight of blood, Guattani talked over this subject with the patient, assured him that he had provided every thing for stopping the blood, and explained to him at the same time how easy it would be to enlarge his small incision, in case of there being pus only in the tumor; he mentioned also, that in case of pure blood flowing, he would presently give it a free exit, so as at least to empty the bag, and would let the fresh blood run out, even after the emptying of the bag, if his strength would bear it; after which he pledged himself to secure the artery by compression, if he could only get his compress fairly put down upon the artery itself." "After all this," says Guattani, "I trust there will come on a good suppuration, and that you will be restored to perfect health; at

all events, this is expressly what must be done, and all that can be done to attain that defirable end."

"Morrellus heard me," says Guattani, "with a composed mind, and we proceeded to our operation boldly; being provided with basons for receiving the matter, and compresses and bandages for commanding the blood. Then the surgeon Maximinus introduced his curved bistoury delicately into the highest point of the tumor, near the crista ilii where the skin was particularly thin, when instantly pure blood gushed out violently to the great alarm of all present. But encouraging the patient, I took one of the basons," says Guattani, "in my own hand, and extracted such quantities of blood by this small opening, that I filled one bason, took up a second, and still continued my work, till the pure arterial blood began to flow, and the patient to faint." The blood was stopped by Maximinus clapping his thumb upon the orifice; and Guattani, by graduated compresses, piled one above another, with firm bandages, so suppressed the bleeding, that the patient did not faint, but, on the contrary, was presently relieved from all his fever and pain; and being supported with cordials from time to time, he went on without either bleeding or any other bad symptom, and without needing even to have the bandage undone till the 13th day, when the dressings being removed, nothing flowed from the wound but a little pus; which showed that the artery was fairly closed, and encouraged them to go on with the cure. Although the suppuration was not excessive, they were forced to make a counter-opening; they accomplished the cure in little more than two months.

Now the discharge of coagulated blood only followed at first by a discharge of fresh arterial blood; the patient feeling no lowness nor debility during the emptying of the great bag, and his fainting whenever the pure blood began to run; prove this to have been an aneurism, and Guattani's intention in allowing some of the arterial blood to escape, was, that he might have a greater command of the artery, and be enabled to compress it.

It signifies nothing to the point, whether this was or was not an aneurism; nor, if truly an aneurism does it signify whether it were an aneurism of a branch only, or of the main artery of the thigh; nor is it of much importance whether the aneurism was above or below the point at which the profunda goes off. The question is, whether the main artery was stopped above the profunda by the violent compression which they needed to make? And this is solved by Guattani's reflections upon the case, which are as follows:

"This case settles," says Guattani, "two great questions which disturbed me very much; for, in the first place, the pressure was such as to prevent the least drop of blood from passing down the artery, whence I was satisfied that the limb was nourished by the internal iliac artery alone; and since this aneurism was cured by compression merely, I am satisfied that compression will cure any aneurism, whether from wound or from disease."

The strong conclusions of this case also, the celebrated Murray tries to escape, by saying, "*Vero simile videtur, arteriam femoralem supra inguen jam divisam fuisse, nam alioquin, toto trunco compresso, vix ausa tam fortunate cessissent.*" If this femoral artery did actually divide into two equal trunks, which way could they pass along to the thigh but over the pelvis? or how escape that compression which obliterates so effectually both the femoral artery and the profunda? Yet why should we allow ourselves to argue thus about a mere hypothesis? This is but the old analogy of the brachial artery forking high in the arm! a *lusus naturæ* is imagined to fulfil that purpose for which nature has so very amply provided; those authors would rather have a limb saved by miracle than by the provisions naturally belonging to its own organization! But you know by what provision of nature such a limb is saved, and how to overlook the authority even of Murray when opposed to facts.

CONCLUSION.

There is no general fact in all the circle of pathology, of which we are more absolutely assured than of this universal inosculation of the vessels of a limb, and of the general obliteration of its arteries, without any danger of gangrene. The proofs which I have laid before you are like a great experiment, varied in every possible form, and with circumstances so peculiarly striking, as to impress the fact on our imagination, as well as to satisfy our reason. In one case, a natural aneurism is enlarged to the utmost possible extension, the parts ready to burst, the artery obstructed even by the pressure which its own disease had produced; the limb lying swelled and deformed, with hardly any remains of vital heat, verging towards gangrene. Then the collaterals enlarge, the limb warms, the circulation returns, the limb at last grows turgid with blood, its heat rises beyond the natural

standard, and the patient awakens as from a sleep of death. When the limb thus recovers, the swelling subsides, the strength of the limb is gradually restored, but in the place where the trunk of its blood-vessels should be found, there is only a firm cord of ligamentous substance, knotty and hard, occupying the bed of the obliterated artery.

In a second case, we see the same process under another form. The aneurism bursts within, the blood is driven far and wide among the cellular substance, the artery is torn up from its bed, and insulated and compressed, the muscles are displaced, the extravasation occupies every interstice, the parts and their functions are disordered to the utmost degree, but the distension stops short of gangrene! the aneurism bursts at last, the circulation on the fore part of the limb ceases, that along the back part of the limb is established, the patient lives some weeks, and then expires exhausted by fever, pain, and every kind of distress. Upon opening this limb, the artery is found to have been dilated into an aneurism, the canal of the artery is found choked at its upper part with a firm clot of blood, the aneurism is found to have burst in the middle space of the artery, and in its lower part the artery is flattened, its sides have adhered, and its canal is obliterated where it approaches the ham! Such a patient surviving this destruction of the vessels during four weeks, is as sufficient a proof of our doctrine as if he had lived for years.

But still, as if for our entire satisfaction, another variety of the case appears; the aneurism bursts internally; the circulation is for some hours almost interrupted; the heat of the limb is at length restored; the artery is obliterated, and discharges no more blood, but it has already injected the cellular substance with blood beyond what living parts can bear; they gangrene; the skin bursts; the thigh opens as if to show what had passed within; the parts slough like the surface of a gun-shot wound; the cellular substance is purged away by suppuration till the muscles are cleansed; you can count the muscles as they lie in the bottom of the great sac; the triangular hollow which lodged the great vessels is exposed. Though the great vessels have been long destroyed, yet the patient continues to live; or, if he dies after much suffering, it is only because he is exhausted by the fever and profuse discharge.

Yet this is but as a theory; these facts do no doubt establish a sort of abstract point of doctrine, "that though the great arteries of a limb be destroyed, the limb may survive;" yet there is here no authority for the practical surgeon, who is responsible for

every new and dangerous operation ; he must have proofs more relevant than this, and such proof we have in the two operations which I have last described. In the case by Mr. Hammick, the femoral artery was torn or burst from sphacelation, and the current of its blood interrupted ! it was tied close to the groin ! after an interval of suspended circulation, the limb recovered its heat, and there was too fatal a proof of a lively circulation, for in no long time the circulation became too powerful for the weakened arteries to resist ; that blood which was now passing freely, and nourishing the limb, burst out from below through the sphacelating and sloughing artery ; it was in consequence of hæmorrhagy by this retrograde channel that the patient died.

But, last of all, in the case of Morrellus ; the operation for aneurism was boldly and successfully performed by the two great Roman surgeons Maximinus and Guattani, who, amidst a confusion of blood and matter, aneurism and abscess, sought out the artery, found it, obliterated it by compression, and actually saved the patient from death that seemed inevitable.

As I proceed in this important subject, you will find me describing a variety of aneurisms ; and since I have taught you to reason upon these facts, you will, without my assistance perceive, that in every aneurism cured by bandage the artery is obliterated by compression, and also that every aneurism spontaneously cured, is cured merely by the obliteration of the artery. But I am now engaged in explaining the efficacy of inosculating arteries ; and one department of the circulating system remains to be slightly noticed, I mean the economy of the arteries of the arm, where also the powers of the circulation will be found equal to every interruption.

THIRD, OF THE INOSCULATIONS WHICH IN CASES OF ANEURISM OR WOUND SUPPLY THE PLACE
OF THE BRACHIAL ARTERY.

Though the arm is smaller than the lower extremity, a circumstance worthy of attention, according to the doctrines of the older physicians, this did not at all abate their apprehensions, they believed that stopping the axillary artery must be followed by gangrene of the arm ! But according to the doctrine which I have

laid down, the size of a limb makes no difference in this argument, the arteries of each limb are proportioned to its bulk, the inosculation of arteries is essential to the sound constitution of each part, and the inosculations of arteries are proportioned to their size; the arm, like the lower extremity, is endowed with every provision for supporting its circulation under the accidents of wounds and aneurisms; its arteries are proportioned in size to the bulk of the limb; and the order of the inosculating arteries in the upper and in the lower extremities is nearly the same.

First, The arteries which surround the fleshy joint of the shoulder may be very aptly compared with those which surround the hip: One very long and slender artery comes out of the thorax, it is among the first branches of the subclavian artery, often it is an independent branch, not unfrequently it is the chief branch of the lower thyroid artery, it is long and tortuous, and passes directly across the root of the neck; it enters into the notch in the upper border of the scapula, and supplies the muscles which cover the shoulder blade; it is called the *Transversalis Humeri*, but should rather be named the *Supra-Scapular Artery* *. This is a branch on which we may rely, for it makes many inosculations with the next branch, the sub-scapular artery.

Secondly, The sub-scapular artery is exceedingly large; it is equal in diameter to the humeral artery itself; it bears the same proportion to the axillary artery that the *Profunda Femoris* does to the iliac artery at the groin; it comes off from the axillary artery nearly opposite to the shoulder joint; it turns immediately round the edge of the scapula, and makes very free inosculations with the extreme branches of the supra-scapular artery, and with those long and slender arteries called *Cervical*, which twine round the root of the neck and top of the shoulder.

The third artery is a great one, though often it is but a branch of this sub-scapular artery; it comes off at the joint, and no sooner does it leave the axillary artery, than it turns quickly round the joint, to which it is so entire-

* This artery is regular, in so far as relates to the scapula, but in its origin it is quite irregular. This great artery going over the scapula, named *Supra-Scapular artery*, or *Arteria Dorsalis Scapulæ*, most commonly comes from within the chest, being the first great branch of the *THYROID ARTERY*; sometimes it proceeds from the *CERVICALIS*, or artery of the neck; sometimes it comes off upon the outside of the chest; it makes large inosculations, and is the branch particularly to be depended upon; but all the cervical arteries assist with their lesser inosculations, and all of them, or any one of them, may be so enlarged as to perform this office of filling the trunk of the artery below the axilla, and so nourishing the artery.

ly appropriated, that it is called *Articularis*, or *Circumflexa Humeri*, from its course round the joint; while the supra-scapular and sub-scapular arteries nourish all those muscles which lie upon the scapula, this artery supplies the deltoid muscle, the shoulder joint, and the arm bone. Such is the size of these arteries, the frequency of their anastomoses, and the fleshiness of the joint, that injections pass easily from the subclavian artery into the humeral artery, although the intermediate part of the trunk, viz. the axillary artery, be tied. Often, when we have tied both axillary arteries with the design of injecting only the head, we find that even our coarsest injection has passed freely into the artery of the arm; and thus that point of the circulation which surgeons have been most doubtful of, is perfectly ensured*.

Next, when the artery passes the border of the axilla, and takes the name of Brachial Artery, it gives off one or two branches, which resemble the profunda femoris, as far at least as an analogy can hold betwixt so bulky and so small a limb. These arteries are called Muscular Arteries of the arm, or Muscular Spiral Arteries, from the spiral form in which the uppermost of the two twines round the arm; they are named Profunda Humeri, superior and inferior, from the analogy of the femoral artery; they are named sometimes Collateral Arteries, because they run parallel with the trunk of the humeral artery. These two arteries terminate in twigs, which encircle the naked and bony joint of the elbow. One curls round the inner condyle, and the other (the muscular spiral), which by passing round the arm has got to the outside of the arm, twines round the outer condyle. These arteries are long, slender, of the size of crow quills; the twigs they distribute round the elbow joint are small and curling. Along with these there

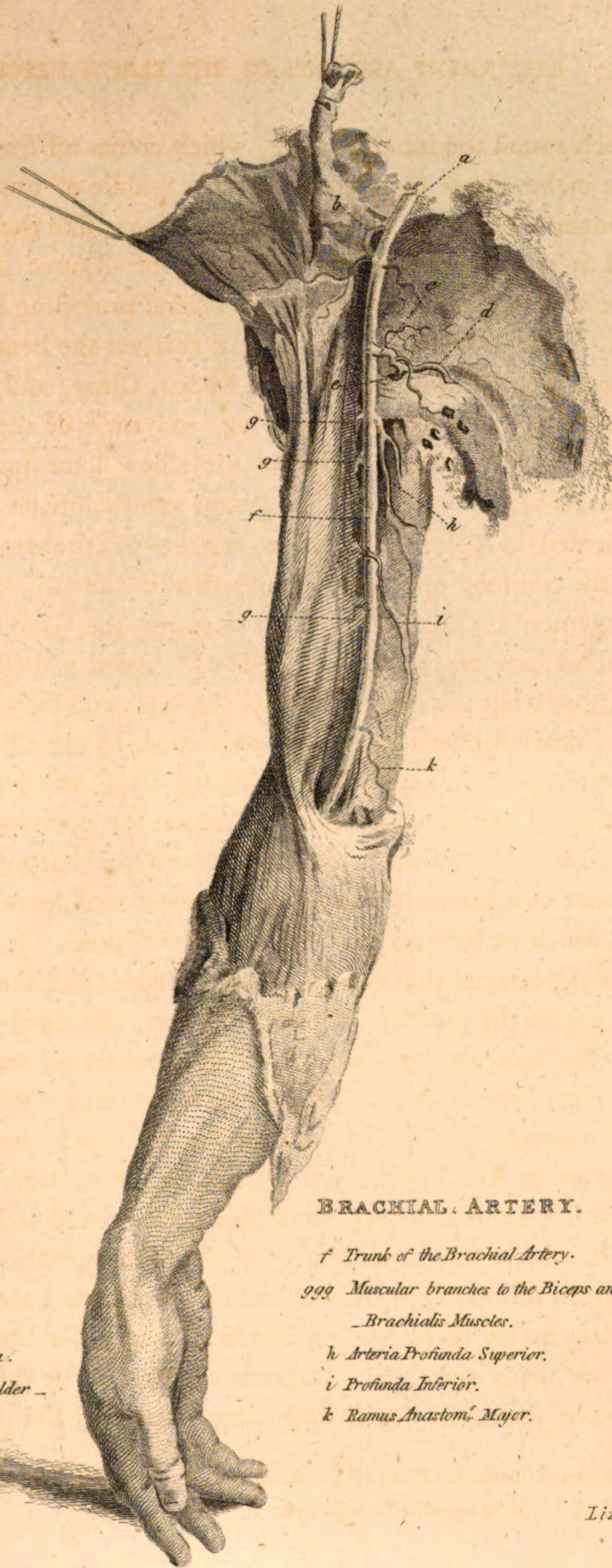
* Whether the great artery be wounded just where it comes from under the clavicle, i. e. betwixt that great branch which goes over the scapula and that which goes round the scapula from below; or whether it be wounded betwixt the lower scapular artery and the profunda, still the limb is safe; we are assured of it by cases; we foresee the success of all such operations by the success of our injections; I have often found, that when, even in the oldest subjects, I had pushed injection (of the coarsest kind), from the arch of the aorta, trying to save the arteries of the arm for a second injection, by tying both arteries in the axilla very securely, I have, notwithstanding, had an injection of the arteries of the arm; sometimes in both arms, more frequently only in one; but even one experiment of the kind, and one arm injected, were a sufficient proof.

And you will be inclined to consider this proof as a very strong one, when I inform you that our coarsest injection goes thus freely round the anastomoses of the shoulder, (where we are so much afraid of performing an operation) while even tepid water will not pass, or will scarcely pass round the anastomoses of the elbow, where, in our operations for the common aneurism, we are so sure of success.

goes a branch round the inner condyle, which comes off from the humeral artery about three inches above the elbow, near the middle of the arm; it descends towards the inner condyle, it is slender and tortuous like the branches of the profunda, and it is distinguished by the name of *Ramus Anastomoticus Major*. These three arteries then twine round the several projecting bones which form the elbow joint. The humeral artery having reached the bend of the arm, divides into the three well known arteries, the Radial, Ulnar, and Interosseous arteries; they resemble the three arteries of the leg, and each of these sends back a little artery, which, turning quickly round the elbow joint in a retrograde course, mixes its branches with those of the ramus anastomoticus and of the profunda. These are named the Recurrent Arteries, and they are the arteries which support the limb after the common operation for aneurism in the arm. We see and feel the actual enlargement of the artery which supports the limb, and it is usually that branch which I have represented in the Plan *, and it adds strength to the general conclusion, that while the anastomoses of the large and fleshy joint of the shoulder transmit our coarsest injections, those anastomoses of the elbow joint hardly transmit tepid water in their natural and undilated state, and yet never fail to support the circulation of the blood after the operation for aneurism.

This is the economy of the arteries of the arm, and these the anastomoses upon which we have now learnt to depend with perfect confidence; but this is a degree of boldness which we have acquired by very slow degrees. It is principle alone, and the study of the arteries that can give us confidence; and the study of the arteries, essential as it is to the practice of our profession, has been entirely neglected by surgeons. The anastomosing arteries have been observed only by professed anatomists, and that very slightly. So little have surgeons acted upon principle, that when any important question of this kind has presented, the conclusion has always been, "Let us try whether the anastomoses will so enlarge as to save the limb." Wounds of the femoral artery were always considered as fatal to the circulation of the limb, which was accordingly cut off: The operation for aneurism of the ham was, from mismanagement and bad surgery, almost always fatal: In wounds of the axillary artery there was no question made, the limb was cut off without delay. It was many ages before surgeons ventured to tie the artery, in aneurism, at the bend of the arm: For a long time after they did perform the operation,

* The *Recurrentes Ulnaris*, see Plans of the Arm, which are sketched in the General Plans of the Anastomoses, which is placed opposite to page 248.



AXILLARY. ARTERY.

- a* the Axillary Artery
- b* Supra-Scapular Artery.
- c* Subscapular Artery.
- d* Subscapular Artery, bending under the Scapula.
- e* the Arteria Circumflexa or Artery of the Shoulder - Joint.

BRACHIAL. ARTERY.

- f* Trunk of the Brachial Artery.
- g g g* Muscular branches to the Biceps and - Brachialis Muscles.
- h* Arteria Profunda Superior.
- i* Profunda Inferior.
- k* Ramus Anastom. Major.

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it was done with great fear and anxiety, and they kept the amputation-instruments ready at hand, that they might cut off the arm the moment it began to gangrene ! although this much dreaded gangrene, in the course of nearly a century (during which we have continued to perform this adventurous operation), has never once appeared. When this operation did succeed, the older surgeons wondered at their own good fortune, and ascribed it to one of two causes, either that the branch only of the humeral artery, viz. the ulnar artery was wounded by the lancet, and not the trunk ! or, that the humeral artery divided near the shoulder, far above the place of the wound ! That the trunk itself was wounded, tied, obliterated, and yet the arm saved, they could never believe ; even repeated success could hardly inspire them with confidence. Where is the case related in which gangrene followed from the interruption of the blood ! Nowhere. And yet, to this day, the arm, after such an operation, is laid in particular postures, and wrapped in flannel and furs, and fomented with spirituous embrocations, all to restore the circulation ! as if the surgeon could perform, or even promote that process which nature alone can achieve, and has indeed very carefully provided for. The surgeon's self-approbation, when the heat of the limb revives, is like the pride of the fly on the chariot wheel. He puts his oar in the water, but he is carried by the tide and the stream *.

Heister believed, that wherever we cured the aneurism of the arm by tying the artery, the arm was saved by a high forking of the artery, and it was only latterly that he began to suspect that the smaller branches might sometimes be so far enlarged as to carry the blood freely ; because he had occasionally observed, that after the operation for aneurism, there was no pulse in the wrist during three days, after which it began to be perceived, and soon returned to its natural strength †.

* We find the celebrated Ruish speaking of this operation in the following terms : " This is an operation which surgeons chose rather to describe than to perform. I have good reason to say so, since for more than twenty years, in all this great city, to which so many under all kinds of ailments crowd for assistance, no surgeon, as far as I have heard, has ventured to tie so great an artery."

It is commonly said, that Ruish was actually the first who had performed this operation in Holland ; whereas the passage stands thus : " Operationem sane ab authoribus majus commendatam et laudatam quam institutam ; quod dicere non gravor, quia viginti abhinc annis, et quod excurrit in hac vasta civitate, ad quam sine numero confluant afflicti, hanc operationem in arteria adeo ingenti nullus (quantum noverim) chirurgorum instituit." Ruish, Vol. I. Observ. 2:

† " Posse vero ramulos minores se ita sensim dilatare, ut § XXXVIII. diximus, Clar. Du. Præses inde suspicatur, quia cum aliquando truncum arteriæ brachialis internum, graviter vulneratum, prædicta ratione supra vulnus ope filii circumdicti ligasset, intra triduum nullum in arteria juxta carpum posita, quæ à medicis

“ If the axillary artery be wounded (says Mr. Gooch) it is necessary to take the limb off at the joint ; yet as there are instances of the brachial artery dividing into two, soon after it leaves the axilla, which *lusus naturæ* I have observed at different distances in the arm (for Mr. Gooch had a natural turn for observing these *lusus naturæ*), it will be rational practice when we feel a pulsation at the wrist, to treat such case as an aneurism, by tying the artery,” &c. P. 72.

In short, there were two accidents with which the older surgeons encouraged one another to this operation, viz. first, that the artery forked very high in the axilla ; or, secondly, that in common an artery touched with the lancet in bleeding, was pricked not in its trunk, but only in one of the two branches into which it divides at the elbow. Thus Cheselden says, “ I had always thought this wound was in the inferior cubital (i. e. in the ulnar) artery, and thus the sudden reflux of the blood was accounted for, by the communication of the two cubital arteries in the palm of the hand, and thus satisfied, I inquired no further ; though Mr. Sharp, even so long ago as when he was my apprentice, told me that the wound was in the trunk, in the humeral artery itself, as indeed it is.” P. 457. And yet the celebrated Dr. William Hunter, notwithstanding this affirmation of Cheselden, lays it down in the most formal positive manner, in the shape of a practical rule or inference, we know not what to call it, marked xv. “ That though the brachial artery in most people divides into its two branches a little below the part where we commonly bleed ; yet perhaps it will be found, that the aneurism happens oftener to one of the branches than to the trunk of that artery, because these often lie nearer the skin, and are thereby more exposed to injury.” P. 353.

This has nothing in it of the usual correctness of Dr. Hunter, for in point of fact it is wrong ; the branches do not lie nearer to the skin, they are buried deep, not under the fascia only, but under the bellies of the pronators and flexors of the arm, and any one may know this, who has ever in his life tied up an arm for bleeding, where he must have observed the artery beating strongly only where it is undivided, where it runs in one trunk under the median basilic vein. Dr. Hunter's reasoning is even more mistaken than his assertion ; for if in most people the artery divide a little below the place where we bleed, it matters little whether below that point the two branches be superficial or deep, the aneurism cannot happen “ oftener to one of the branches than to the trunk.”

explorari solet, pulsus sentire aut percipere potuit : posthæc vero hanc arteriam, primo levissime micare, sensim vero sensimque penitus pulsare sensit.”

The more we investigate these arteries and their inosculations, the greater reason shall we find to trust even in their slenderest branches for the nourishment of a limb. Surgeons have been ignorant of this property of the circulating system. It is by neglecting anatomy that they have found it difficult to imagine, a priori, how a limb should be saved after its great artery is wounded, and they never could deduce such a conclusion from practice, for a reason which I am now going to assign.

It often happens that a limb is cruelly wounded, and its great artery at the same time cut across; this appears as the most fatal accident, and, from the moment that the surgeon knows of the wound of the main artery, that alone dwells upon his mind. He announces to the relations of his patient the danger of gangrene, and when the gangrene does come on, he ascribes it to the cause which is usually assigned, the mere wound of the main artery, without attending to the complicated nature of the case! The wound is of great extent; the limb is bruised, and, almost from the first moment, in a state of gangrene; the bones are broken, and the blood of the great artery driven deep among the disordered and lacerated parts. The limb perhaps is wounded with a ball, but still the wound of the great artery alone dwells on the surgeon's mind; he forgets the disorders and natural dangers of a gun-shot wound or compound fracture, and imputes the gangrene merely to the wound of the arterial trunk.

The condition of such a limb is very different from what is usually supposed: When the artery is wounded, tied, and the blood interrupted, it is imagined that the limb is deprived of blood; that it dies of immediate direct gangrene; that the gangrene is from the want of blood! But it is quite otherwise; the whole arteries are thrown into the most violent excitement; the limb is gorged with blood; its arterial system works with uncommon impetuosity; every twig is dilated to carry its proportion of the interrupted blood; and if to this gorged condition of the limb are superadded such injuries as proceed from the passing of a waggon-wheel over the limb, a gun-shot wound, bruised flesh, and broken bones, there cannot fail to happen a very sudden gangrene, but not without a previous stage of inflammation, and the highest possible excitement of the limb.

Much of our practice depends on this doctrine, which I shall afterwards explain more fully; at present I would only remark the nature of the deception to which the surgeon is so much exposed.

If a man will look only superficially on these matters, or will be satisfied with

general conclusions deduced from the accidents of only one particular case, then indeed he will be hurried along into this rash practice of cutting off arms as well as legs: Or, in other words, if to establish this rule of surgery, nothing more were required than an authentic case of a wounded axillary artery, followed by gangrene and death, such proofs might be found in every common book. Thus Mr. Gooch tells us, p. 76. "That he was called by a neighbouring surgeon to attend along with him a man who had been just before, in a state of excessive intoxication, thrown from his cart, the wheels of which had passed over the top of his arm and shoulder, bruising all the parts quite up to his neck, while an iron hoop, projecting from the cart, had cut him under the arm, tearing fairly across the artery and all the great nerves which go down along the arm."

"The limb was wholly deprived of sensation and motion, they felt no pulse at the wrist, and they concluded that the brachial artery was divided, although the bleeding which was at first profuse, had stopped, partly by the retraction of the artery, and partly by their having tied down his arm to his side."

"Had not the drunken condition of the patient, and the violent contusion of the parts surrounding the joint, discouraged us (says Gooch), we should have proposed immediate amputation at the joint. The next morning the arm appeared in different parts discoloured, emphysematous, and gangrenous; by noon it was totally dead and insensible to the finger-ends; and on the third day, towards the evening, the patient expired. The day after his death, the arm was so thoroughly putrid that we were unable to dissect it, till after having washed it well with warm vinegar and spirits, we opened it, and found the bundle of the great nerves entirely cut across, and the artery also divided, and its upper end retracted an inch into the axilla." But this, far from being a general proof, is an accident merely: The death of this person is explained by the general circumstances of the case; the inebriation of the patient, his loss of blood, the cutting of the whole bundle of axillary nerves, are of themselves sufficient to account for his death. Perhaps he died as Captain M—— did (whose case is related by the celebrated Mr. White), rather from his inebriation, loss of blood, and wounded nerves, than from the necessary consequences of his wound; for Captain M——'s arm preserved its circulation; its heat had returned; the vein swelled upon putting a ligature round the arm; he died after the arm was safe from all the consequences of the tying the artery.

But this case, related by Mr. Gooch, was complicated with other accidents;

for we are told that they were deterred from amputation, by the bruised condition of the parts furrounding the joint. The wheel had passed along the arm and shoulder quite up to the neck ; these parts were black ; and, I dare say, little better than gangrenous : Is it at all surprising, that an arm so mangled, upon a body so hurt and disordered, fell into immediate gangrene ?

Hence we see the folly of deducing any general conclusion from an individual case, and we are reminded of this good rule in philosophy, that one positive evidence must outweigh any number of negative proofs. If we can find but one single example of an axillary artery wounded, and the arm saved, it is then a settled point, that in favourable circumstances the inosculating arteries round the shoulder will save the arm ; and the conclusion will stand firm ; though there should be produced against that single recovery a whole host of negative proofs they will signify nothing. It evidently becomes our duty, whenever we are presented with a case seeming to contradict this positive proof, to inquire into the circumstances and accidents which have made that one case fail, while another operation has been followed by such perfect success. As the purest case, the least complicated, and the most unequivocal example of success, I put down the following.

“ About sixty years ago, Mr. Hall was called to a man in Cheshire, who had received a very considerable wound, just below the axilla, by a scythe which had divided the brachial artery. The man soon fainted away with the loss of blood, which preserved his life, as nobody was near him. Mr. Hall, being only accidentally in the neighbourhood, had no needles with him ; but as soon as he arrived, he easily laid hold of the artery with his finger and thumb, till he could procure some thread, which he immediately tied round the vessel, and effectually secured it. *The man recovered the use of his arm ;* though he had ever after a weak and trembling pulse *.”

It was the broadness and openness of this wound that enabled the surgeon to see the bleeding artery, and to take it up so fairly, as to save at once both the life and the limb of the patient ; for in many other cases, it has only been by consenting to lose the limb that the patient has saved his life ; or where the limb has been saved from amputation, it has in general hung, shrunk, lifeless, by his side †.

* Vid. White's case of Captain Mounsey.

† It was more than suspected more than a hundred years ago, that in aneurisms of the brachial artery the vessel might be tied even in the axilla, without danger of gangrene. “ Imo posse constringi filo trun-

If it were worth while, I would carefully explain the chief accidents of this kind, so as to prove the following positions: That the wound of the axillary is less dangerous still than wounds of the femoral artery; that when gangrene has seemed to proceed from a wound of the axillary artery, it has been owing rather to the complications and accidents of the case; that when, together with a wound of the artery, the bones are fractured, or the soft parts bruised, as with a waggon-wheel, the cure will be almost impossible, and the parts must fall into gangrene; that where, by the force of the artery driving the blood inwards, the cellular substance and the interstices of the muscles are filled, or (as I may say, rather) injected with blood, we shall have a slow and tedious cure; that if the inosculating arteries be torn in a lacerated wound, or their circulation disordered and interrupted by a high inflammation and swelling of the parts, that also will make a very doubtful case, and in those circumstances it must be dangerous to attempt the cure. But all these do not belong to the general question; they are merely the peculiarities of the individual case; they are indeed the very points to be debated in any great consultation; but they are not arguments for a general rule. Let, therefore, the surgeon do as he sees prudent in cases of wounded arteries, with lacerated flesh, broken bones, a disordered system, a weakly habit of body; but on no account should he allow himself, in a simple wound of any great artery, even to consult about cutting off the limb.

From this pitiful timidity, the most horrible, and, I may say, unnatural things cum arteriæ axillaris, supra præcipuas illius bifurcationes si inibi aneurisma excitatum fuerit, procul a metu necrosis membri subsequaturæ vel alterius symptomatis; id quod postremo notum esse volui Dom. de Blignini et aliis." MORELLUS, *Nesodocheii Charitatis*.

Thus, the communications of Sharp, Cheffelden, and Le Dran, on this subject, lose much of their value. This was not a mere doctrine, the theory thus delivered, and indeed anxiously inculcated by Morellus, was backed with facts. The following case is remarkable: "A young man having been wounded in a duel, on the fore part of the arm, had the artery and vein cut across near the axilla. The hæmorrhagy was dreadful, and knowing well that it could not be repressed by astringents, I had recourse to the ligature, in the following manner: I passed a large crooked needle through the sound part above the wound, driving it so deep that it went close to the bone; it pierced the long extensor (viz. the long head of the triceps), and it passed through the belly of the biceps on the fore part of the arm. The ligature was very strong; so placing a compress on the skin to prevent it cutting, I drew it hard, till it fairly compressed the artery and vein. There was no further hæmorrhagy, and the man did well." Though this be but a coarse business, yet the success is flattering, and is good evidence on this interesting point of practice. The case is related by Mr. Samuel Formi, a surgeon of Montpelier.

are done ; a man having an aneurism is absolutely allowed to bleed to death, after nature, unassisted and alone, has almost accomplished the cure.

* “ A foldier of the 3d regiment of Foot Guards perceived a swelling in his axilla for which he could assign no cause. The surgeon of his corps knew it to be an aneurism. The tumor increased slowly for nine or ten months. His surgeon, unwilling to adventure upon a desperate operation, had him conveyed to St. George’s Hospital. The tumor then had acquired a very great size, had extended itself from the axilla far down the arm ; it still had some pulsation, but the pulse at the wrist was weak and feeble. “ The regimental surgeon, and the physicians of the Hospital, thought the tumor was situated too high up to attempt any operation.” When they had pronounced this sentence of death, they recommended palliatives and anodynes.

“ It was in October that he was conveyed to the Hospital ; he lived on to the end of November or beginning of December, when the tumor began to rise in the middle, and at last it burst on the 29th of December, and the patient died of a profuse hæmorrhagy.

“ Upon dissecting the body, the tumor was found to extend above two-thirds down the arm ; the axillary artery opened into the sac, the artery itself being undilated and found ; the walls of the sac seemed to be continuous with the coats of the artery ; the sac itself was filled with large lamellated polypous concretions ; and, along with these, a quantity of fluid and grumous blood. The lower part of the humeral artery lay behind this aneurismal sac, and was quite impervious for half an inch ; for, just below where the arterial trunk opened laterally into the sac, the continued trunk of the artery was quite obliterated by the adhesion of its sides.”

From the circumstances of this dissection, we cannot doubt that the main artery was entirely obliterated. From its being closed by “ an adhesion of its sides,” we are assured that this obliteration of the artery had been slow and gradual. From “ the rest of the humeral artery and the radial and ulnar arteries being still open, but much smaller than they commonly are in adult subjects,” we are assured that the change in the circulation, so desirable, and yet so much dreaded, had actually taken place, the main trunk of the artery had been entirely closed, while the arteries below had been more sparingly filled by the inosculat-

* For the following case, see a paper on Aneurisms, by Dr. Monro, Edinburgh. *Essays Physical and Literary*, Vol. III. p. 196.

ing branches. We are, moreover, assured (from the following observation), that the circulation through the inosculating arteries was fully established; that they had continued to support the arm for a month. "This swelling gradually increased, and its pulsation as gradually diminished, so that at last only a tremulous motion could be observed in it; the pulse in the wrist grew daily weaker, and at last ceased entirely; in the *end of November*, or *beginning of December*, the tumor began to rise in the middle, and on the *29th of December* it burst, and he died of the hæmorrhagy."

What a sad picture is here of the state of surgical practice in the greatest and noblest hospital in London! The tumor compresses the humeral artery two-thirds of its length; the tumor itself is obstructed with coagula; the tumor loses its pulsation, and the blood ceases to pass through the artery. Then the pulse of the wrist becomes small and fluttering, it ceases at last, and yet the arm continues to live; the process of obliteration is slow, but it is so complete, that the sides of the artery adhere, the arm survives this change in the circulation a whole month, perhaps more; and yet, when the aneurism bursts, the surgeons allow the patient to expire from loss of blood! What is our profession good for, if we are to allow such a patient to die? if we refuse a patient those means which Nature has appointed for saving life? Surgeons and physicians, deliberating with absurd formality about inosculating arteries, might resolve thus to let the patient expire, but his honest and ignorant friends would not have done so; with common sense only to direct them, and full of the natural feelings of humanity, they would have judged that nothing worse could happen him than to die, and would no doubt have tried to stop the blood!

OF THE GENERAL EFFECTS OF INOSCULATION, INVOLVING SOME GENERAL DOCTRINES IN SURGERY.

While I instruct you more particularly in the doctrine of aneurisms, I must not forget that I am teaching you the general principles of surgery. This doctrine of inosculations is to serve you as a sort of general theory of aneurisms, and before I leave this subject, I will take notice of some peculiarities in the actions of the extreme arteries and in the general circulation of the blood, which depend

in some degree upon the inosculation of vessels one with another ; for inosculations are not mere accidents, but are essential to the health of the parts, and destined for more important purposes than are usually supposed. This frequent inosculation of vessels cannot be intended only for disease. Disease makes those inosculations apparent, and gives us an interest in them, since it is on them alone that we depend in our most dangerous operations ; but it is surely to be supposed that the inosculations serve, even while the body is sound, some important purpose ; we have reason to believe, that in health as well as in disease the blood often moves in the limbs and in the viscera, not in a direct, but in a retrograde course.

According to the old doctrines of physiology, the blood could move no way but directly onwards by the impulse of one central power, the contraction of the heart, and return in its course to the heart by the veins, moving still onwards in one direct circle. This idea was quite familiar with the old physiologists. They considered the whole body, the arteries, and veins, and glands, and viscera, with all the apparatus of secretion and excretion, as a mere hydraulic machine, consisting of elastic tubes, subject to the laws of fluids in motion. The heart they regarded as the sole moving power, and its stroke as the sole impulse by which alone the blood was urged onwards to the extremities of the system ; and as they delighted to adorn Nature with powers of their own imagining, they wasted much ingenuity in explaining the power of the heart, and took a pleasure in calculating, and in exaggerating the force of that muscle : They proved, indeed, that its powers must be infinite ; for having first assumed as a principle that it was the sole mover, they proved easily that the resistance must increase, and the effect of this central force be abated the further each part of the body to which the blood was propelled was removed from the centre. They said, the heart had to force onwards a vast column of blood, that it had to overcome the elastic resistance of the arteries, to unfold all their tortuous branches, and to push the blood onwards to their extremities through all their intricate convolutions, through glands, viscera, and the various secreting organs ; that this column of blood must be moved in opposition to the power of gravitation in raising it to the higher parts of the body, and that it must be moved through all parts of the body in opposition to the weight of the parts themselves, and to the pressure of the atmosphere. They never accounted as any thing the contractile power of the vessels ; they never reckoned the arteries as an assistance to the heart ; they regarded the elastic power of the vessels rather

a dead weight upon the heart, as opposing it; they never supposed that force which urges on the blood to be distributed equally through the system; they imagined the whole power to reside in the centre; and the whole system of vessels as in direct opposition to this central power.

Thus, in their zeal to magnify the propelling power of the heart, they continued to enumerate the resistances which it had to overcome, till they proved a sum of resistance such as no single part, however great its power, could be supposed to overcome; and very erroneous were the conclusions which resulted from those premises. It was conjectured that the motion of the blood was slower and more difficult as it receded from the heart; that it was very languid in the extreme vessels, whence obstruction and gangrene were frequent in the extremities; obstructions, inflammations, fevers, and all diseases, were deduced from a slow transmission of the fluids, arising from viscidities, tenacity, and error loci, or in other terms, from the particles of the blood entering into arteries unfit to receive them. Those physiologists never ascribed any active disease to the living power of the vessels, to the enlargement or increased action of particular arteries. Inflammations, tumors, and aneurisms, they ascribed to such weakness of the parts that the power of the heart was enabled to prevail over them and dilate them.

When a limb was cut off, they were fearful lest the heart should prove too powerful for the more limited circle it had to supply with blood; and they bled regularly for some months, after great amputations, in order to lessen the power of the heart over the arteries, and to prevent the bursting of the vessels of the stomach or lungs. They believed, contrary to their daily experience, that an artery could not be tied without danger of being dilated by the force of the heart, and for this reason refused to tie up the great arteries in aneurisms of the limbs. All diseases were explained by the words *lentos*, *remora*, viscidities of the blood, obstruction in the extreme vessels, or irritation and febrile action in the heart. They proceeded in their calculations upon the pure principles of hydraulics, without ever regarding the vessels of the living body as alive. They considered the circulating system as a set of elastic and inactive tubes; and Keil the anatomist, and his brother the astronomer, calculated the laws of the circulating fluids, and deduced the motions of the animal fluids, the secretions, the perspiration, and all the phenomena of health and disease, from this mistaken principle, from this *petitio principii*, "That the various velocities of the fluids are proportioned to the various distances of the several organs from the heart!"

Nor have modern phyfiologists entirely changed the ground. It is upon the same principle that the most celebrated phyfiologists of the present day have attempted to calculate the power of the heart. They have assumed, "That the power of the heart and the mechanical strength of the arteries have a just proportion to each other, that by ascertaining the one, we may guess at the other." It is upon this *petitio principii* that they have proposed from the mechanical strength of the arteries to calculate the impulsive power of the heart! But is it really an artery whose strength they are thus endeavouring to ascertain? When they take a portion of a great artery to compare it with a portion of a small one, or with a portion of a vein; when they stretch it out in their air pump, expose it to the pressure of the atmosphere, and measure, according to the descent of the mercury, the exact force it is capable of bearing! is it really an artery whose strength they are calculating? No; it is a part of a dead body, a piece of leather, a strip of parchment; "it was an artery;" it was once a muscular artery, endowed with living powers, capable of contraction when stimulated, capable of great contractions when highly excited, and of great resistance when much extended, of various strength, according to the health of the body! but now that it is dead, it has but one invariable power, that of cohesion, the mere property of dead matter, proportioned only to the density of its coats. It is to be remembered, that a muscle which could lift great weights when alive, will bear but a very small one when dead; this power of the living muscle has no share in these calculations, it is indeed incalculable.

Whatever has been imagined by these mechanical physicians respecting the circulation of the blood, has been contradicted by experiment. The motion of the blood, far from being retarded in proportion to the distance of the parts from the heart, is more lively and rapid in proportion to the smallness of the arteries. The blood in the tail of a fish, for instance, without being urged onwards by any vis à tergo, continues for ten minutes after it has been severed from the body; and in many animals the circulation of the blood in the mesentery survives for a little while the separation of the heart from the system. The blood, while the parts are entire, does not move always in the same direction with that which issues from the heart. The circulation of the blood is by no means commanded by the power of the heart, it is easily disturbed; a slight accident or obstruction makes the arteries turn the tide of the circulation into a retrograde course directly opposite to that impulse which it receives from the heart; for, when you open a vessel, the blood runs

from both ends, and returns by a retrograde course from all the adjoining vessels to the wounded part. When you stop an artery, the blood runs backwards in it, forfakes the obstructed artery, and passes along other arteries in a backward course. In such circumstances the blood is not driven in this retrograde course by the force of the heart, but by the action of the arteries, which are thus emptied of their blood. There are some insects in which we see only a muscular aorta working the blood along, and there have been born monstrous foetuses having no heart, whose blood, of course, had been circulated merely by the muscular power of the aorta. Fishes have three successive circles of blood; one circle for the lungs, through the bronchial arteries; a second through the body, by a muscular aorta; and the blood of this second circle is urged a third time through the circulation of the liver by a vena porta, without any intermediate heart. Successive circulations are thus performed merely by the muscular power of the vessels.

Now while lymphatic vessels, veins, the glands and their ducts, the hollow viscera, the urinary bladder and urethra, the vagina and womb have such contractile powers, why should we suppose the same power wanting in the arteries, which are more plainly muscular than any of all these parts? The perpetual resistance to the circulation, as the vessels recede from the heart, shows the necessity of a propelling power universally distributed and not limited to one central point; and the rapid circulation of the blood in the extreme vessels, its occasional aberrations, the oscillations of the blood running sometimes in one direction, sometimes in another; the effect, especially of inosculating arteries, and the manner in which parts grow both in health and in disease, prove sufficiently that each department of the circulation, in the various limbs, parts and organs of the body, is carried on by the contractile power of its own vessels.

The heart is still the prime mover of the circulating system, its office is to excite the arteries by its stroke, to keep them full, to receive from the veins which are, as it were, the reservoirs of the blood, that exact quantity which the arteries require for their full and perfect action, and to propel it into the general system. But the velocity of the circulation is greater or less in each part, not according to its distance from this active centre, but according to the nature of its function, according to the sort of vessels with which it is endowed, according to the excitement which the part suffers, independently altogether of the general force of the circulation. Thus does general circulation contribute to every partial and local action, by supplying each individual set of vessels with blood, giving them

the stimulus of fulness, preserving a due excitement in the vessels, and preventing any retrograde motion of the blood when the extreme arteries act upon it. The general circulation presents the materials to each organ, but leaves it to work out its own peculiar function, and the irregularity of all the secretions and actions, shows how much these depend upon the excitement of the organ and upon partial contraction of the vessels, how little upon the general circulation. Thus, blushing of the cheeks and erection of the penis, are examples of partial actions of vessels, independent of the general circulation; secretions of every kind, ossification, and the nutrition of the soft parts are examples of appropriated vessels acting towards particular purposes, independent of the general system. And atrophies and wastings, inflammations, swellings, and tumors, hæmorrhages and profuse discharges, afford examples of the too weak or too powerful action of particular sets of vessels.

It may, I believe, be received as a principle of the circulation, that in whatever way the demand of blood upon any artery, or set of arteries, is increased, the effect is an accelerated motion of the blood towards that artery. Of this, perhaps, the plainest example is that of the varicose aneurism, where a side passage is opened from the artery directly into the vein, where the arteries of the arm continue to require their usual supply of blood, and where this loss of blood by the side passage of the artery, and the dilatation of the vein makes a new demand upon the trunk. The trunk of the brachial artery enlarges, becomes tortuous, and acts more powerfully to supply this new demand, and the enlargement of the artery is easily felt even through the skin.

Every demand of blood causes enlargement of the arteries leading to the part which demands the blood, and it signifies little whether the blood be thus required in consequence of its passing unnaturally from the side of the artery into the vein with which the artery is united, (as in this example), or whether it be evacuated from the system by many arteries, as in the case of hæmorrhagy, or whether it be expended in nourishing some inordinate growth, in supporting some tumor, or in generating an aneurismal enlargement of certain vessels! still the effect is the same upon the great arteries of the part. A profuse secretion once begun is not easily stopped. A hæmorrhagy is easily established as a habitual disorder with a perpetual tendency to return. A tumor once formed never ceases to grow, and an aneurism once generated distends the vessels continually more and more till it bursts. In every such case, it is the partial action of its arteries that causes this

influx of blood towards any part ; pain and swelling in a tumor is preceded by a sense of pulsation and heat, and the return of hæmorrhagy is portended by the beating of the arteries.

When a tumor once begins, it is, as it were, a morbid secretion. The arteries begin to deposite solid parts, they strengthen in this morbid secretion every day ; and being excited to a more powerful action, they daily increase their demand upon the parent trunk. This action of the lesser arteries of the tumor invites more blood into the greater arteries which feed them. The anastomoses of these arteries enlarge, and they in their turn draw off blood from all the neighbouring arteries, and thus in every growing tumor, as the arteries increase in their size, their activity becomes greater, and the sources from which they derive their blood are multiplied. The smaller arteries which perform the morbid secretion, the more important branches which supply those smaller arteries, and the trunk itself, which is, as it were, the stem of the whole tree, increase in size.

If a gland be the seat of the disease, each subdivision and partition of the gland grows by the increased power of its own particular artery ; it continually increases knob after knob, gland after gland, according to the succession in which each artery assumes this diseased action, till the whole acquires an enormous size, the last increase of the tumor being always in a high proportion more rapid than the first. Tumors have no bounds in their growth ! the smallest glands about the jaws grow to the size of the head ; the testicle grows to the size of the body ; aneurisms increase always till they burst. It is, with few exceptions, the nature of tumors to grow till, according to their various natures, they either fall off from their weight, or become gangrenous and burst, or oppress the adjoining parts so as to cause death. No tumor should be allowed to grow to any dangerous size.

When the arteries of any part are thus set at work, while their trunks increase in size, their veins increase in proportion, and this is plainly the reason why every tumor, whatever be its nature, is marked with turgid veins and conspicuous arteries which never were before known to belong to the part. The vessels being thus increased in size and power, sometimes deposite matter and make a fluid tumor, sometimes they are determined to the secretion of solid parts, and so form a firm or fatty tumor ; and sometimes, from this increased action, proceeds a mere enlargement of the muscular flesh ! I have seen the surgeon digging deep and wide into the thickened muscles of a limb searching in vain for matter, and only cutting through firm and quivering flesh. Frequently veins and arteries work themselves into a di-

lated state without secreting, without evacuating their contents, but forming, by their increased action and gradual dilatation, a very singular aneurism. Thus the excited state of the arteries enlarges the diameters of their canals, and increases the sources of their blood; the arteries and veins work in concert till they begin to pulsate very strongly; their branches are so enlarged at last, and so intricately, as it were, that the substance of the tumor resembles a placenta with numerous arteries and veins opening into a sort of cellular substance! The tumor becomes livid, and its surface pulsates more strongly! the skin wastes, the tumor swells up upon straining, holding the breath, or any uncommon action of the arteries or obstruction of the veins! it bursts from time to time and pours out blood; this is a peculiar kind of aneurism, which might, I think, be named aneurism from anastomosis, and which I shall take an opportunity of describing more fully.

Another consequence of these enlargements is, that the frequent anastomoses of arteries, one with another, which contribute in the healthy state to the free distribution of the blood, contribute remarkably in the diseased state to feed the disease. For when once a set of arteries are enlarged, they will have blood, they will draw it from all sources; though the main arteries were stopped up, the collateral arteries would grow into trunks; and though you tied up what you think the principal arteries of such an aneurismal tumor, you would find those very arteries filled with retrograde blood, beating strongly when you feel the tumor, and bleeding furiously when you cut into it. Another consequence of these frequent anastomoses is, that the force of the circulation in any tumor increases not in a direct, but in a geometrical proportion. For the force of the blood or the violence of pulsation in any one given point, is not in proportion to the mere force of any single artery, but to the combined force of all the arteries anastomosing with it. This is one reason of the rapid growth in the latter stages of this peculiar aneurism, of the powerful pulsation in a whole tumor of which the individual arteries are exceedingly small, and of a solid tumor often receiving so powerful a pulsation from many small arteries, as to be mistaken for an aneurism of some arterial trunk.

The savage nations give us a curious proof of the ease with which vessels may be excited to an increased nutrition, which is indeed an increased secretion of new parts, for simply by exciting the arteries of a part it is enlarged, and savages enlarge to an enormous degree the ears, the nose, the lips, merely by distending them. In diseases, we see the ovaria in women dilated so as to form

enormous bags with firm and fleshy walls, containing within them various sacs, some filled with the transparent waters of a dropsy, some with a gelatinous fluid, some with grumous blood. And in man, we see the spermatic cord, for example, lengthened, the peritoneal process thickened, and the testicle itself increased in size merely by the extension of parts, in consequence of a hernia falling down into the scrotum. For some very extraordinary instances of such enlargement, see the Medical Essays of my friend Mr. Kite of Gravesend, a gentleman of most uncommon ingenuity in physics, and of great knowledge and skill in his own profession.

The growth of the womb in pregnancy is a conspicuous example of this increase of thickness, merely by the dilatation of vessels and accumulation of blood, produced by an excitement of the vessels, and an increased demand for nutritious fluids. For when the womb becomes pregnant, it is excited, and as it were inflamed, its vessels begin a new secretion, its system of arteries is put into action, its veins are proportionably dilated, the form and manner of its growth is determined by the place to which the foetus is attached, which being commonly at one side, the womb grows all to one side, and lies almost always obliquely in the belly. The growth of the womb is limited only by the demand upon its vessels, for the substance of the womb actually thickens as pregnancy advances, and it is, when loaded with twins or with three children, enlarged in proportion. In the enlargement of its arteries and veins, and in the cellular appearance of its internal substance, the pregnant womb resembles that kind of aneurism which I have just described; when it is cut in the Cæsarean section, its bleeding is like that which attends the extirpation of such an aneurism, the blood issues from innumerable points, and the taking up of arteries with the needle and thread in the Cæsarean section is a mere romance.

The growth of the womb in thickness is limited to the ninth month, the foetus is discharged, the womb collapses, the activity of its arteries ceases, and those arteries which had been accustomed to transmit such a profusion of blood return to their ordinary condition. The growth of the womb is altogether a very singular example of this increase of vessels when excited to higher action, for in the womb itself, there are actually two parts distending at once, the one by the force of the excited circulation, and the other by mere extension! the fundus of the womb has the living Ovum connected with it, has a powerful circulation and thickens as it extends; but the Cervix Uteri, the neck of the womb, has no con-

nection with the Ovum, its vessels are not excited, that part is merely extended, it does not grow, but is dilated, begins to stretch towards the end of pregnancy, and grows thinner in proportion to its extension.

This action of arteries, with an increased secretion of fluid or a deposition of solid parts, distinguishes the extension of dead matter from the extension of living parts, which is always a real growth. When the womb is extended, it is thickened, and never after pregnancy returns to the smallness of the virgin womb. When after the birth of the child, the breasts assume a new function, they increase in size, they do not after suckling return to their original smallness, but are the more enlarged the longer the child sucks them, and in warm climates are lengthened to an enormous degree. When the belly of a pregnant woman is distended, it is thickened in its substance, its cellular substance is dilated, its arteries are enlarged, its veins become varicose; and when the abdominal muscles, by contracting, expel the child, and empty the abdomen, the skin never contracts again, but hangs down in bags, loose and pendulous. It is the same in disease! for when the delicate membrane of the peritoneum is forced down along with a hernia, its vessels assume a new activity; they are kept in continual action by their unnatural and pendulous position; they are excited from time to time by new descents of the bowels; and in course of time this delicate membrane thickens into a dense, firm, and very bulky sac.

The most direct dilatation of all, the distension of an artery in forming an aneurism, is not like the extension of a tube of elastic gum, or other inanimate matter. The distension of an artery, (as in natural aneurisms of the femoral artery, or of the aorta), is always accompanied with a remarkable thickening of its coats; it is a real growth; and when, at last, a part of the walls of an aneurism grow thin and burst, it is because that part has suffered extension beyond what the parts can bear; the circulation of a certain portion of the walls of the sac is hurt by the extension, for such extension is equal to pressure, it at last prevents the circulation in the vasa vasorum, in the arteries which nourish the coats of the great artery; the part becomes thin by expansion and want of nourishment, and is little better than dead matter! This is not even an exception to the general rule, it is a confirmation of it. Extension, while the vessels are free and the part nourished, is like a stimulus, and promotes growth; but extension beyond that point which the vessels are capable of bearing, operates like the extension of dead matter, for while the extension goes on, the action of the vessels becomes gradually weaker, the part extends merely without growing, till at last it bursts.

An aneurism is to be opposed by pressure ; the dilatation of an artery may be opposed by tying it ; the increase of a tumor may be stopped by suspending it ; a rule which is not peculiar to the swellings of the testicle, but applicable to every pendulous tumour. When a tumour is cut off, its arteries cease to act ; and when a limb is amputated, its great arteries being stopped, and no blood passing laterally, the stump shrinks, and becomes conical : few stumps continue fleshy and round. In stopping an artery with ligature, whether in an aneurism or in a stump, there is no danger of its dilating, for it is not the force of the heart that urges on the blood, but the action of the arteries which solicits it ; and when the lower arteries belonging to a great trunk are cut off, the demand ceasing in that artery, the blood forsakes it, and the artery which is tied up, instead of being forced by the heart and dilated, is dried up and shrinks ; it is obliterated much higher than the point at which it is obstructed.

Thus we perceive, that the doctrine of Derivation and Revulsion is a true doctrine, though not precisely in that sense in which it was acknowledged by the ancients, and is indeed the principle on which many diseases are to be cured. The irritation and counter-irritation of a late celebrated author, is just this doctrine of derivation ; it is just this action and counter-action of vessels. The effects of fomentations, poultices, onions, warm gums, and adhesive plasters, in promoting slow suppurations ; the effects of setons and issues in curing the diseases of joints, by substituting an increased action of the external surface to the morbid action of the internal parts ; the effects of blisters upon the surface, in relieving inward diseases ; the effects of suspension and of quiet, in stopping the growth of tumors ; and the effects of bandages and firm pressure in healing ulcers, discussing swellings, promoting absorption ; are easily explained. Pressure is said to promote absorption ; but, I believe, it is more useful by compressing the vessels, suppressing their action, and preventing the deposition of nutritious particles, than by promoting absorption, or removing those parts which are already organized. How pressure may prevent the action of arteries, and the deposition of matter, we can easily imagine ; but how pressure can promote the action of absorbents, or of any other vessels, it is hard to conceive. If compression be really useful in suppressing the growth of parts, or preventing the afflux of fluids to any diseased part, it surely ought to be more universally employed.

Perhaps a larger induction of facts might give these speculations more importance, and might enable us to obtain a greater command of the action of parts, so as to counteract disease. But my sole object is to apply the general laws of the

circulating system to the condition of an aneurismal artery; and I believe I shall accomplish this object most easily, and assure myself of the truth of my conclusions, by approximating the laws of the living system to some of the known laws of fluids moving in rigid and inanimate tubes.

First, It is a well known fact, that a tube never delivers its full quantity of fluid; the force of the current is lost by friction. A tube always delivers a column of fluid less than its own diameter; it delivers less in proportion as it is prolonged. A simple bore in the side of a full vessel, delivers a stream of fluid smaller than the diameter of the bore through which it issues. A stream of fluid issuing from a simple bore, or through the mouth of a tube, is constricted; the stream terminates in a sort of focus, and is smaller at a little distance, than where it is just issuing from the mouth of the tube. This resistance at the orifice of a tube, has its effect in a living body, as in varicose aneurism, where both the opening in the side of the artery, and the whole length of the tube above that opening, undergo a proportionate dilatation.

Secondly, The beautiful experiment of Bernoulli proves, that the pressure upon the sides of a tube whose lower orifice is opened and set to run, becomes negative. The cisterns (a) and (b) being filled with water, while the water is allowed to run from (c), the pressure of the water becomes negative on the sides of the tube (d d), in so much that the water rises along the tube (e), from the cistern (b). This explains to us why, when a great artery is opened, it discharges not merely its own blood, all the blood of the adjoining parts follows it; the blood runs in by all the lateral anastomoses, the blood both before and behind runs towards the open mouth.



This retrograde tide of a fluid which happens even in a system of rigid tubes, runs with much greater rapidity in a system of living and contractile arteries, which force their fluids on in whatever direction they find a ready vent. This analogy explains the great afflux of blood towards every growing tumour; for when the arteries in which the main trunk terminates act powerfully, the increased

action of the extreme arteries and their increased demand for blood, is equivalent with the opening of the mouth of a tube ! The lateral arteries give up their blood to the main artery and to its active branches ; the active vessels are filled at the expence of the surrounding parts ; every collateral artery adds its force to that of the main artery, and those branches, which were once supplied from the main artery, now pour their blood backwards into it.

This shows that they are very ignorant of hydraulics who imagine, that the force of the circulating system will bear particularly upon the point where an artery is tied, forcing it so as to endanger a dilatation of it. For if that artery have collateral branches, the fluids will move just as in this experiment, where the mouth (c) being stopped, the pressure of the fluid on the sides of the tube will become direct, and the fluid will move downwards along the collateral tube (e), the collaterals, whatever their number, bearing each an equal proportion of the force. Thus it happens, that, when a great artery is tied in aneurism, its collateral arteries are filled ; and the blood of the main artery being distributed among them they become turgid, are highly excited, they act very powerfully, and supply the place of the trunk, the limb swells, and the heat rises above the natural standard.

But the application of this law of hydraulics to the actual operation of living arteries, require a scheme representing the anastomoses of the smaller arteries, and the probable course of the blood where there is a wound in any important arterial branch. Suppose a set of vessels destined for any glandular part, an intestine, for example ; suppose the walls of a piece of gut to be nourished by parallel arteries of nearly equal size ; suppose our view to include the anastomosis of three arteries, each going on to its own piece of intestine, and each supported by anastomoses from the adjoining branches. Suppose the health to be sound, the part and all the vessels entire, and the action of those vessels powerful ; suppose the movement of the blood to be equally free in each of these vessels, and the individual action of each of the three vessels to be equally balanced, then the blood will move equally onwards in each of the three vessels (a b and c) towards its common destinations (d e f). But suppose that in space (m) there is an inflammation or tumor, some disease, either consisting originally in a too violent action of the extreme branches of the arteries, or causing such increased action, then the middle artery (b) is chiefly excited, its branches are distended with blood, and its trunk and branches act with such increase of power, as to

prevail over the collateral arteries (a and c), their branches come to be distended and excited; the disease thus extends to the adjoining parts, and more arteries are drawn into the diseased action.

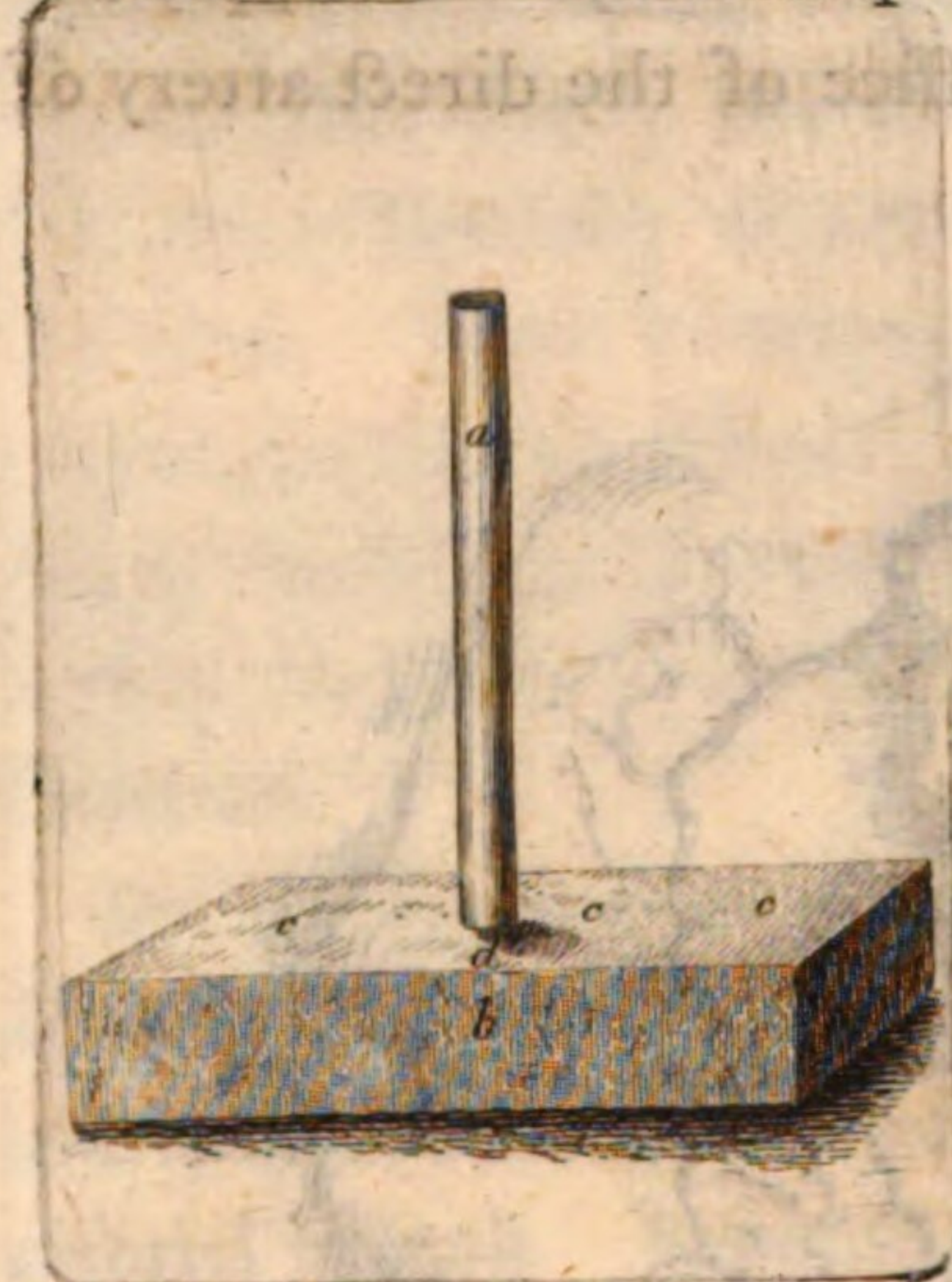
Suppose, on the contrary, that the artery (b) is wounded, that at (g) there is an opening in the canal of the artery which spills its blood. The circulation being unsupported at this point, the blood runs out from the artery (b), it runs backwards from all its branches towards the trunk, and the blood of all the adjacent arteries takes the same direction. The blood of the branches (a and c) no longer passes onwards to its destination (d e e f), but runs a retrograde course through the inosculations (h i k); Lastly, suppose, after any wound or disease, the whole trunk (b) obliterated, its collateral branches (a and c) will supply its place, and their inosculating branches perform the office of the direct artery of the part (b).



This is surely the meaning of inosculating arteries; it is thus that each branch is supported by its collateral arteries; it is thus that the circulating blood turns aside from any obstruction into new channels; it is thus that disease is propagated by the action of vessels from branch to branch over large surfaces, and also through the substance of the diseased part; and it is thus that the inosculations, or in other terms the vascular connections of a part, limit its diseases. It is from such vascular connections that inflammations is transmitted from the scalp to the scull,

from the scull to the dura mater, for these are the three parts of one system of vessels; it is thus that inflammations are propagated from the pleura to the lungs, the pericardium, and the heart itself; it is thus that inflammations and other diseases are limited to the liver, the kidney, the spleen, or other organs whose vessels lie within themselves; and it is thus that inflammations of a general cavity, as the abdomen, affects all the viscera, and that inflammation or other disease of the cellular substance or skin, as erysipelas, for example, has no limits, for the vascular connections of the cellular substance are such that its diseases not only undermine the skin, but surround the muscles, and penetrate to the bones.

Another proposition which I shall have occasion to apply to the general doctrine of aneurisms is this. The pressure of fluids is equable in all directions upwards as well



as downwards, so that a tube (a) being immersed in a cistern, the perpendicular pressure of the fluid in the direction (a) is proportioned to the height of the column; and that pressure being communicated to the water in the cistern (b), is equal on all parts of the surface; and the pressure on each of the points (c c) of the cistern is equal to the pressure upon the point (d), and the pressure upon the whole surface (c c) is the same as of a column of water equal in height to (a), and as broad as the whole surface (c c). In consequence of this law of the equilibrium of fluids, one very remarkable

phenomenon presents itself in every great aneurism, viz. that the pulsation increases in a very singular manner indeed; without attending to this law of hydraulics, we cannot imagine how a single artery can communicate so powerful an impulse to a large aneurismal sac. But such pulsation is not proportioned to the artery which enters into the sac, but to the extent of the sac itself. The sac expands daily, the pulsation increases in proportion to its extent; there is not merely an apparent increase of motion, there is a real impulse, and this force increases till it becomes irresistible, drives open the bones of the thorax (if the aneurism be confined to that cavity), or, if it be a popliteal aneurism confined by the muscles of the ham, it distends the tendons, makes the bones carious by the pressure, and then bursts.

Another very singular circumstance results from comparing this law of hydrostatics with the various species of aneurism; and it is this, that a very small artery

entering into a large aneurismal sac gives a very powerful pulsation, because the pulsation is always proportioned, not to the size of the artery, but to the size of the sac. This is plainly the reason why, in that kind of aneurism, which I call Aneurism by Anastomosis, where many little arteries open into a sort of cellular substance, the pulsation feels as heavy as if the tumor were the dilatation of some great artery; and this is the reason why the retrograde blood of small anastomosing branches, when they enter into an aneurismal sac (as in the case where Mr. Pott was so alarmed as to cut off the leg), have such singular power over the sac of an aneurism which was originally great, which was formed and filled by the femoral artery! for these small inosculating arteries no sooner fill the bag with blood, than their stroke begins to affect the sac, and they communicate to it as powerful a pulsation, or, at least, as sensible a throbbing, as if the great artery actually opened into the sac.

CONCLUSION.

Thus have I proved to you, that there are no arteries in any limb entitled to the appropriated name of Inosculating Arteries; that inosculation is a form and property of all arteries, essential to a free and perfect circulation of the blood: Whereas, surgeons have observed hitherto no inosculations, but those which are enlarged in aneurism; have known no inosculating arteries, but those from which they expect the safety of a wounded limb: They seem to have imagined, that nature has appointed particular inosculating arteries to nourish the limb, when they choose to perform their operations in the ham, or at the bend of the arm! never reflecting on the admirable wisdom with which all parts of the body, even the slightest and almost invisible inosculations of arteries, are made to contribute to its preservation.

Inosculations assist the free circulation of the blood, and allow of retrograde motions when required. Inosculations, by connecting many arteries, enable the blood to leave those vessels which are obstructed, or cut off, and serve to accumulate the force of many arteries upon that point where the vessels are particularly required to act. Inosculations increase all the powers of the circulation in

the extreme arteries, and are multiplied in exact proportion as the arteries recede from the heart.

Inosculation endows the circulating system with particular aptitudes and powers; it is essential to free circulation, secretion, and nourishment, to the function of the glands and viscera, to the regeneration of parts that are destroyed, to the saving of parts that are injured; and this equable motion of the blood in every direction is essential to adhesion.

The power of inosculation knows no limits, but, like adhesion, is perfect in all parts of the body wherever vessels exist! no part of the body is lost for want of adhesion; neither can any part be lost for want of inosculation. Who could have believed that a bone could adhere to a bone! Who could have believed that the cornea, when cut open in extracting the cataract, or the crystalline humour when displaced in couching, could adhere to the surrounding parts? Who could have believed that the carotids could be stopped up! the aorta itself interrupted! the vena cava quite obliterated! the thoracic duct oppressed, so as no longer to transmit the lymph, without life being endangered? Who could have believed that the femoral artery, and all its branches on the fore part of the limb, might be obliterated, without the limb falling into gangrene? Surely I am entitled to that broad and universal conclusion to which I have laid claim.

This fear of interrupting the great arteries proceeded merely from ignorance of pathology. Reason and experience concur to prove that it is safe; and I feel myself entitled to lay down, at the conclusion of this discourse, a rule, the very reverse of that with which it began. After these proofs, the questions about inosculations may be blotted out altogether. Wounds of the axillary artery, like wounds of the femoral artery, are often dangerous from secondary bleeding, but never fatal from the want of inosculations. We may tie the greatest arteries confidently, wherever they are wounded without the trunk of the body. We should tie as boldly the arteries at the groin or in the axilla, as in the lesser branches going down the thigh or arm. Accidents (as we are in all our operations at the mercy of accident) may undoubtedly prevent our achieving a cure! A limb bruised with a waggon-wheel, or wounded with a great ball, cannot be so easily saved, as when the artery alone is wounded by the stab of a knife or sword. Yet although the accidents and dangers of gangrene were multiplied tenfold! this common way of cutting off the thigh, or amputating the arm at the shoulder joint, should be forsaken; it is bad doctrine, and cruel practice.

EXPLANATION OF THE PLANS

OF THE

CIRCULATING SYSTEM,

To face Page 310.

IN this plan of the Circulating System, I have been chiefly attentive to demonstrate three great sets of inosculations: First, The inosculations of the thoracic and epigastric arteries with each other: Secondly, The inosculations of the arteries of the shoulder and haunch round the scapula and pelvis: Thirdly, The inosculations of the articular arteries round the joints of the elbow and knee.

FIGURE I.

The great artery, the aorta, marked (a), conveys blood to the whole system. After departing from the heart, it forms its arch at the root of the neck (b), where it gives off arteries to the head and to the arms; and having descended along the back, it forks at (c) in the loins into two great arteries, supplying the pelvis and lower extremities.

FIRST, It is obvious that there can be no inosculation of the aorta with any other great vessel like itself; but the aorta is no sooner divided into branches for the upper and lower extremities, than those great branches for the limbs inosculate with each other; for even before the axillary artery departs from the thorax, it gives off the internal mammary artery (i), which turns downwards, and passes along the sternum within the thorax; and the femoral artery, before it emerges from under Paupart's ligament, gives off the epigastric artery (2), which turns upwards along the belly, within the flesh of the rectus muscle. These arteries inosculate about the borders of the chest (3), and such is the nature of this vascular connection, that (being assisted by some other small arteries, as the intercostals, d d d d) this, the epigastric, along with the thoracic arteries, has supplied the place even of the aorta itself, as I believe I have proved, page 245.

SECONDLY, The main artery of the arm having advanced to the shoulder, divides into two arteries, of nearly equal size, the one going along the arm to nourish it, while the other, consisting of two great branches, named scapular arteries (e e), turns round the scapula. In like manner, the iliac artery (f f) (the general artery destined for the pelvis and lower extremities) divides into two sets of vessels; first, the arteries named Sciadic, Pudic, and Glutæal, which all proceed from one great artery, destined for the pelvis, marked (g g), and turn immediately round the haunch-bone; and, secondly, the proper femoral artery (h h), which goes down along the thigh and leg. The scapular arteries inosculate round the scapula with the branches of the humeral artery; the arteries of the pelvis inosculate freely round the haunch-bone with the first branches of the femoral artery, and so freely, that the interruption of the main artery of the leg or arm can never prove fatal merely from want of circulation! though a combination of unfortunate circum-

EXPLANATION OF THE PLANS OF THE BLOOD-VESSELS.

stances surely may cause gangrene, vid. page 289. These arteries inosculate so freely, that a coarse injection will pass through the arteries surrounding the joint into the main artery of the limb by the inosculating branches.

THIRDLY, At the elbow and at the knee-joints, the main artery of the limb sends off small arteries above the joint, which, from their twisting round it, are called collateral, or articular, or inosculating arteries: these are met from below by small branches from the arteries of the leg and fore-arm, which, from their turning backwards round the joint, are named recurrent arteries. So small and delicate are these arteries, that the main trunk of the limb, being tied either at the bending of the elbow, or at the ham, no injection can be forced round through the inosculating branches! yet they enlarge so easily, and do so perfectly support the limb when we perform the operation for aneurism, that we make no hesitation in performing that operation, which, thirty years ago, was only done in mere despair, and with the amputation instruments at hand.

A fortiori, the arteries inosculating round the haunch and shoulder, which carry a coarse injection so easily, assure us of the arm surviving, even when the brachial or femoral arteries are tied close to the trunk.

The three smaller figures show those slender arteries which surround the joints. Fig. 2. Shows the popliteal artery, where (a) expresses the main artery itself; (b) occasional branches to the gastrocnemii muscles, one of which, the muscular branches, is always particularly long and large; (c) marks the two superior articular arteries going round the outside of the knee-joint; (d) marks the superior articular artery going round the inside of the joint; (e) marks the inferior articular artery going round the inside of the knee, a large artery; and (f) marks the lower external articular, or circumflex, bending round the outside of the joint.

Fig. 3. Shows the fore-part of the knee-joint, and the articular arteries are seen turning round the fore-part of the knee; (g) marks the two superior articular arteries on the outside of the knee-joint; (h) marks two long branches, also twisting round the inside; and (i) marks a very large, and constant recurrent artery, which turns upwards from the anterior fibular artery; this branch is seen here, at (k), just making its exit from betwixt the bones.

Fig. 4. Shows the arm thrown out along the dissecting board: The main artery, the humeral artery, is marked (a a); the division into the radial, ulnar, and interosseous arteries, is marked (b); the ulnar (c), the radial (d), the interosseous (e); the profunda humeri superior is marked (f), the profunda humeri inferior, is marked (g), and the ramus anastomoticus major is marked (h); the ulnar recurrent is marked (i), the radial recurrent is marked (k), and the interosseous recurrent is marked (l). The inosculation of the recurrent and anastomosing arteries are too delicate to be seen, even in an injected arm, unless the arteries be very well filled.

Fig. 1.



Fig. 2.

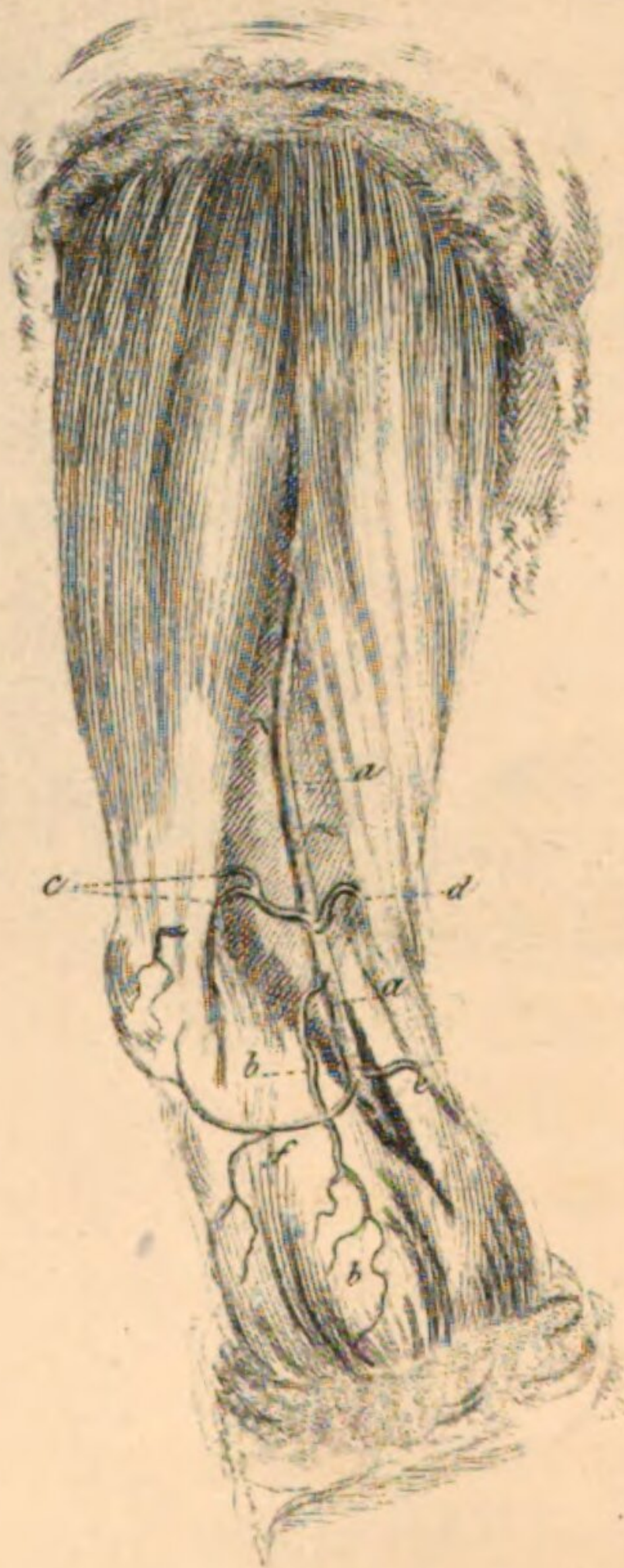


Fig. 3.

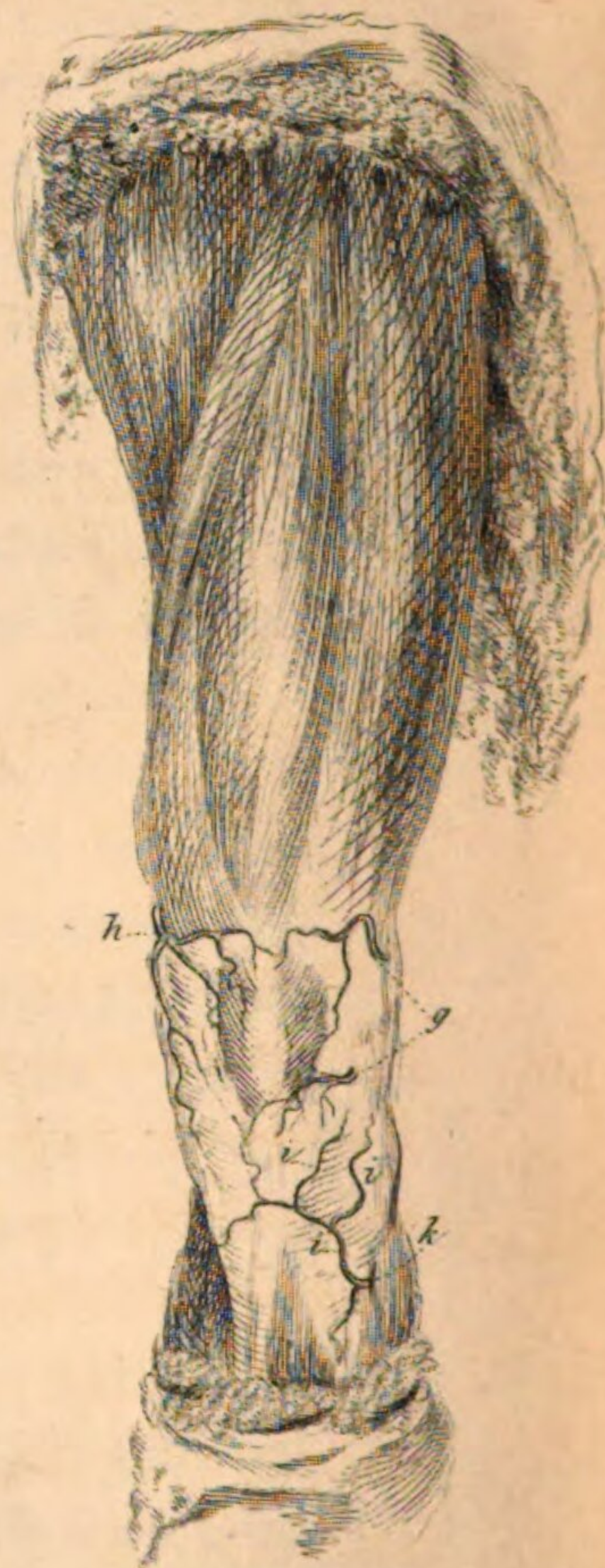
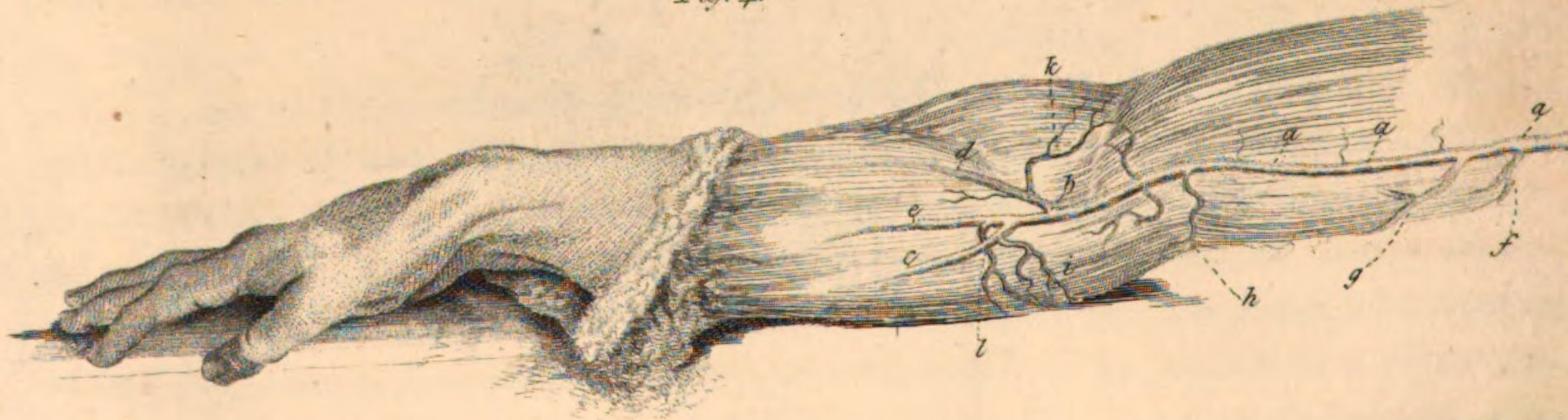


Fig. 4.



DISCOURSE VII.

THE HISTORY AND CAUSES OF ANEURISMS.

“ WOULD you know,” says the celebrated Guattani, “ how I was inspired with love for my profession and enthusiasm in study ! I will relate the manner of it very willingly, for, in truth, certain accidents which struck my imagination early in life were the cause. † First, A bailiff who had been shot with a pistol in the bend of the arm, was laid in the hospital of the Holy Ghost, where, for seven days, his cure proceeded with every favourable sign ; but would you believe it ! on the morning of the eighth day when I went to visit this man, the attendants met me and told me he was dead ? This unaccountable and sudden death induced me to dissect the body, I found the side of the artery open, and the eschar which the ball had produced partly adhering, partly separated, no bigger than a grain of corn ; it was by the sudden yielding of this eschar that he lost his life ! Almost on the same day, another whose artery had been pricked in bleeding, died of the hæmorrhagy without even an attempt to save his life ! Another whose aneurism was in the ham, had a caustic applied to it, and when the eschar fell off he bled to death ! Another still had his aneurism opened with an actual cautery and immediately expired from loss of blood ! To these dismal scenes which I myself have witnessed, what numbers might I not add from the consultations and writings of others ? ”

If you, Gentlemen, have not yet witnessed the uncertainty that prevails in consultations about aneurisms of the great arteries ; the hurry, confusion, and dismay, so legible in every countenance while the bloody operation is performing ; if you have not, when the unhappy patient has been left to his fate, observed the pulsation increasing from day to day, nor felt the awful throbbing, nor seen the blood

† This is not a literal translation of the text of Guattani, these accidents awakened in him, not this general love of study, but a particular desire to study aneurism. “ Quod si scire aves, inde in me originem duxerit prurigo in universa chirurgia quæ tam longe lateque diffunditur, hanc unam excipiendi græmio, ferioque excolendi materiam.”

welling out through the cracked, livid, and gangrenous skin, preludes to that last torrent by which the man is to expire ! if you have not yet seen the affecting situation of such a patient beyond the reach of help resigning himself to his fate, you cannot feel all the importance of this subject.

I will boldly neglect those insignificant definitions which never can circumscribe a subject like this, definitions such as no sensible student will value, nor any wise teacher attempt ; and proceed to give you a full and plain history of aneurisms ! For decision and judgment in operating or in consulting, depend not on curious and nice distinctions, but on universal knowledge. I will endeavour therefore to disclose to you the true principles of pathology, to lay before you all the materials for further study, to teach you habits of reflecting and deliberating upon the nature of this disease.

DESCRIPTIONS OF ANEURISMS.

Aneurism, when it arises without blow or hurt, steals on slowly. A small tumor is felt for instance in the ham, it is small at first and firm, and but little affected by the pulsation of the artery. It lies deep among the flesh, and must be felt for by **working in** the fingers and pressing aside the adjacent parts. It is supposed to be a knot or kernel, has little pain, is neglected for many weeks, and might be mistaken even by a surgeon for a swelled gland. This little tumor grows, and beats more strongly, but an ignorant and hard working man is not easily alarmed, nor willing to forsake the daily labours by which he provides for his family. Still the tumor beats strongly, and the patient is at times alarmed ; there is an unaccountable heaviness, pain, and numbness through all the limb, and by those shooting pains and this heavy lameness, he is obliged to ask advice. The surgeon with marks so decisive as these, knows this throbbing tumor to be an aneurism ; he offers the man his assistance, begs him to submit to regimen, low diet, confinement, and a gentle bandage ; he advises him to go to an hospital, but the patient is unwilling to think thus seriously of his disease.

From week to week this poor man works and rests alternately, is careless of the limb, still hoping that it is but a slight complaint, till at last by pain, lameness, he is confined to bed ; and by the intense throbbing he is truly alarmed. The

surgeon, now called again, is also seriously alarmed, he finds the tumor throbbing strongly, increasing rapidly, beginning to fill up the cavity of the ham, yet too painful, and too much inflamed to suffer compression; but while he is hesitating what to do, or whether an operation may be proposed, it often happens that a second aneurism begins to form in the other ham.

In a few weeks this ham also is distended with a hard, firm, and throbbing tumor, hard as a stone, and rising strongly with each pulse of the artery. The leg becomes œdematous, the thigh swells, the whole limb becomes heavy, cold, and pulseless; perhaps the pulsation in the tumor ceases, but the parts still continue thick, the tumor firm, but not yet threatening to burst. After some weeks of suffering, another tumor appears in the opposite thigh, and as if from the greater power of the femoral artery, or from the whole arterial system being predisposed to disease, this third aneurism increases with a rapidity wholly alarming. Which of these great aneurisms shall burst and be the cause of death, seems long doubtful, till, as if the greater aneurism of the thigh had drawn off the blood to itself, the progress of the original tumor is no longer observed, the aneurism of the thigh increases from day to day, and the patient now weakened by many months confinement, is quite exhausted with pain and fever, and constant suffering. If he survive, the greater tumor becomes livid, the skin becomes thinner from day to day, but not softer, it is parched and hard as if from want of nourishment, it cracks and scabs, and then blood issues through the crevices. For ten days he is sensible of approaching death, and asks for opiates that he may die quietly; at last the blood bursts out, he immediately faints, but is saved from this first hæmorrhagy; he falls low, is seized with sickness and vomiting, a low delirium comes on, and the next morning, after a slight discharge of blood, he expires.

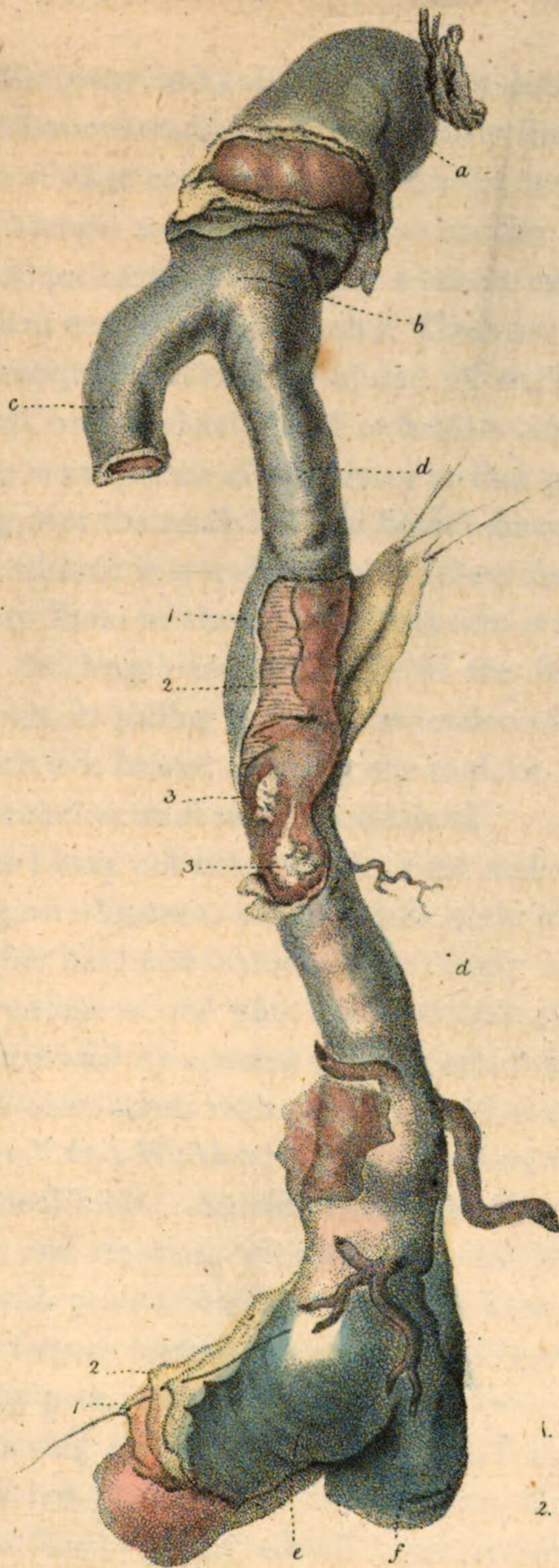
How can we doubt that this is truly a spontaneous aneurism proceeding from a disease of the whole arterial system which needs no exciting cause, when tumor rises after tumor, in the ham, in the thigh, in the groin, without any obvious injury? Such tumors begin during sickness and convalescence, while the patient is in a state of perfect quiet, and while there is not even the slightest fever to account for this dilatation of the artery; but if doubts concerning its nature remain, we generally find them all resolved by the dissection of the body. These successive aneurisms are found to be true dilatations of the artery, there is no breach of the arterial coats, the cellular, the muscular, the villous coats are thickened as they approach the dilated part, and may be fairly traced over the aneurism-

mal tumor, it is on the tumor indeed that the several coats are most distinctly traced. But strong as this predisposition is, we are astonished to find these dilations end gradually and gently in the sound artery, which has in the intermediate parts not the slightest mark of disease, the arterial system being throughout limber, soft, and natural.

But aneurism often arises not only from this inscrutable predisposition, but from an actual and manifest disease of the arterial system. This disease is represented in the drawing which I have formerly given of a rigid ossifying and dilated artery. We find throughout the arterial system, the coats of the arteries thickened and brittle, their cellular substance loose and spongy, with spots and specks of ossification besetting the great arterial trunks. We find the great arteries dilated where they give off their larger branches, and the arch of the aorta or beginning of the subclavian arteries in an aneurismal state, while the lower part of the aorta is small, crooked, and irregular. These are the marks of a disease which prevails towards the decline of life; it is often observed before the fortieth year; but it is singular, that till the approach of that period of life, natural aneurisms are extremely rare: Aneurisms are rare in women, or rather they are never heard of in that sex; they are frequent in strong and hard working men, but in them also they rarely occur till after the thirtieth year, when their arteries begin to acquire this hard and rigid condition. At that period of life, in laborious and hard working men, the joints are not stiff nor their muscles shrunk, they feel strong and healthy, they are in the habits of strong occasional exertions and continual labour, they are accustomed also to violent actions of the limbs, such as their arteries are but ill able to bear. In short, the defects of old age have come upon the arteries sooner than upon the rest of the system, the arteries are unequal to those exertions of which the muscular frame is still capable, one part of the system is weakened before another, which is the very essence of disease, or predisposition to disease.

Yet this predisposition is of such a nature, that it seldom degenerates into aneurism without some direct violence. In all parts of the body there are weaknesses and imperfections which we are made sensible of only by the part being hurt. Aneurisms of the limbs are never known in women, their system is lax, and what is more favourable, they are exempted from those exertions by which the arteries are often injured or burst. Aneurism is rare in young men, and frequent in the middle stage of life when the arteries become harder, when the muscular strength is unabated, and the occasional exertions of the limbs very violent. Aneurism is almost

Drawing of Diseased & Ossifying Artery - its Cellular Substance thickened
and its Coats separated from one another



- a. the Aorta
- b. its Bifurcation
- c. the Stump of one Iliac Artery
- d. the whole length of the other Iliac Artery
- e. External Iliac or Femoral Artery
- f. Internal Iliac or Hypogast. Artery

- 1. The External Cellular Coat of the Artery
- 2. the Middle or Muscular Coat
- 3. the Internal or Villous Coat Ossifying.

J. Bell del.

peculiar to men in the lower ranks of life, to soldiers, porters, labourers, miners, and those who work at laborious trades ; it is particularly frequent in postillions, troopers, and the drivers of stage coaches, and though the tumor has at first all the signs and appearances of natural aneurism, yet there are few of those enlargements of the artery which cannot be distinctly traced to some external injury, some blow, sprain, fall, or violent exertion of the limb ! There are few, indeed, that do not immediately and perceptibly follow the injury. Often, I am persuaded, the artery is not merely injured, but absolutely burst or broken across ! Aneurism of the ham is more frequent, in consequence of the artery at that part lying close under the knee joint, bending over the condyles, and bound down by the heads of the gastrocnemii muscles, whence it is endangered by every sudden motion of the joint, and affected by every strain of the limb. Aneurism is frequent also in the thigh, in consequence of the length and great size of the femoral artery, its oblique course round the thigh, its passing through the tendon of the triceps, and from the manner also in which it is braced down by the muscles. The operation of these various causes of laceration must next be explained.

An artery such as I have just described it, rigid and diseased, an artery which tears under the surgeon's ligature, which bursts upon injection, which, in dissections, feels so palpably hard and brittle, is not surely calculated to resist violent strains or sudden motions of the joint ; and accordingly we sometimes find an artery perceptibly lacerated by external violence and sudden bending of the joint, just as it might be broken across with the finger and thumb in dissection.

" Three years ago," says Walther, " I had the long wished-for opportunity of dissecting an aneurismal limb. An old man about fifty years of age, of a constitution naturally hale and vigorous, was confined to his bed, crooked with rheumatism, and tortured with pains in his knees ; his left knee especially gave him great distress, "*Chiragra fregerit articulos veteris ramalia fagi.*" This miserable creature being wretchedly poor, instead of sending for better assistance, applied to an old woman, who, having first extended his crooked knee very violently, wrapped it up in some of her plasters *. This extension of his knee was extremely painful to him, and he soon perceived a small tumor upon the popliteal artery, it pul-

* "OBSERVATIO.—Tertius volvitur annus cum jam dudum exoptata mihi daretur occasio, aneurisma arteriæ popliteæ examini anatomico subicere. Vir quinquaginta circiter annos natus corporis robusti et sani, doloribus rheumaticis circa genua excruciatu, in lecto per aliquot septimanas retentus fuit, summum vero dolorem in genu sinistro sensit. Miser, qui in summa paupertate vixit, aniculam in auxilium vocabat, hæc

fated very strongly, and upon the slightest pressure produced exquisite pain. This aneurism gradually increased to an enormous size, and it was only when the poor man became sensible of having no other chance for life, that he submitted to amputation."

"The limb was immediately carried to Walther's rooms, where, upon dissection, it was found, that the popliteal artery was dilated into an aneurismal bag of a heart-like shape, of three inches broad and four inches long, occupying the main artery from a little below where it gives off its two upper articular arteries, to within an inch of that point where it divides into the tibial and fibular arteries. The heads of the gastrocnemii solæi and plantar muscles, where they covered the sac, were extended to a remarkable degree of thickness, and the great vein and nerve raised by the tumor, were protruded betwixt the two heads of the gastrocnemii muscles, so as to be in close contact with the skin."

In the drawing of this aneurism by Walther, which is indeed very beautiful, we see ossæous concretions occupying the coats of the tibial and fibular arteries below the aneurism. We have every reason to presume, that in the ham, and in the upper parts of the femoral arteries, these specks of ossification must have been much broader and more frequent. These ossifications are the surest marks of this brittle unyielding state of a great artery. The "veteris ramalia fagi," the crooked and knotty branches of an exhausted tree, may serve as an apt emblem of this artery, rigid, unyielding, and brittle, and we have no reason to wonder at the effects of the quackish old woman's extending the contracted joint thus suddenly. An artery must, like the ligaments and other parts; where the joint continues for any length of time thus crooked and stiff, be proportionably shortened, and an artery in this brittle state must be unfit to bear sudden extension. In this instance, some of these brittle ossifications had given way or hurt the adjoining parts, the remaining coats of the artery had dilated into a true aneurism, the artery certainly had been injured, though not entirely lacerated, for the drawing represents a true aneurism, a sac entire and continuous with the arterial coats.

But the aneurism often so immediately succeeds the blow or fall! the tumor, statim genu finistrum unguentis et emplastris tegebat, præprimis vero violento modo, genu propter dolores flexum, extendit. Facta extensione æger adhuc graviores persensit dolores, imprimis vero brevi temporis spatio elapso, animadvertit tuberculum in arteria poplitea, quod valde pulsabat atque vel leniter compressum ægro dolores concitabat. Increvit tandem aneurisma ad stupendam magnitudinem, et cum infelici non alia vitæ spes superesset, quam chirurgica operatio, amputatio dicta, ille se huic subjecit."—"Die subsequente peracta operatione, femur cum crure præcisum, calidum adhuc, mihi oblatum fuit."

the pain, the lameness so instantaneously follow the injury done to the artery, that we can have no doubt of its being absolutely lacerated so as to produce a false aneurism, I mean an immediate extravasation of blood, and not a mere dilatation of the arterial tube.

John Robertson, a carpenter, a young man in full health, who had never felt the slightest uneasiness in his thigh, in whom there was no reason to suspect any previous disease, got very drunk and fell several times in the streets. Before the third day, he began to perceive a swelling in the middle of his thigh, which had a strong pulsation, and was very painful, and by the eleventh day both the swelling and pain had increased considerably. He was then conveyed to St. George's Hospital, and on the twelfth day the surgeons held a consultation on his case. "They were of opinion, in one voice, that this was a *FALSE ANEURISM* occasioned by the rupture of *SOME* large artery; that the aneurismal sac ought to be opened, and, if the ruptured vessel was found to be only a collateral branch, that it ought to be tied, but if it proved to be the trunk of the crural artery which was ruptured, that the amputating the limb was the only method to be used! to save the patient's life." The sac being opened, it was found to be actually the crural artery which had burst, the limb was amputated accordingly and the man survived*."

In the natural aneurisms which I have hitherto described, we see the slow dilatation of an artery. The tumor is at first without pain, small, firm, and to be felt only by working the fingers deep among the flesh of the thigh. At first it is not to be distinguished even by the surgeon from a small lymphatic tumor receiving the pulsation of some contiguous artery, and such tumor increases for months before it assumes the pulsation, pain, and other characteristics of an aneurism. But when, as it often happens, a man in the very time of falling, as in the instance of a blow, or sprain, feels pain in the ham †, when he observes that he has from that moment considerable pain in laying his leg across; when, on the third or fourth day he feels distinctly the pulsation, pain, and lameness, which are the peculiar signs of aneurism, what reason can there be for doubting that the artery is burst? None, surely, but the slowness with which the aneurism grows. The slow manner, then, in which even the greater arteries of the body form their aneurism must next be explained.

We are naturally inclined to believe that an artery thus broken or lacerated, must form its aneurism the moment its coats give way, and must be able to over-

* Physical Essays and Observations of Edinburgh, Vol. III. page 217, 218.

† This man felt no pain in the moment, because he was drunk.

come all resistance from the surrounding parts in a few days ! But here we are deceived ; we must not regard the artery as a naked and insulated tube, such as is represented in Figure 1st, merely laid along the limb, unconnected with the surrounding parts, unsupported by cellular substance. The artery has a cellular coat in which it is lodged ; this coat is so peculiar as to be called the sheath or capsule of the artery, and is closely connected with the proper coats of the artery by cellular substance and numerous vessels, which strengthen, support, and nourish it ; and when the proper coats of an artery are torn, the blood is not widely extravasated, but is confined by this sheath of cellular membrane which is very slowly forced, or separated from the artery. Even after the sheath is separated from the artery it does not entirely give way, but its cellular substance is kneaded as it were with the half coagulated blood, and rises into a tumor somewhat resembling the thrombus which rises over an ill closed vein.

Fig. 2d represents the true and natural condition of the artery which is everywhere nourished by its cellular sheath, and (a) represents a laceration or rupture of the artery, showing how the sheath and cellular substance (a a) is opposed at (b) to the exit of the blood.

Fig. 3d represents the aneurism already beginning to form. Here is once more represented, the continued sheath (a a), within which the great artery is enclosed ; large branches (b b), such as the profunda femoris, and smaller muscular twigs, (c c) are marked going off from the great trunk, each having its own peculiar sheath. For the smallest arteries are as well supported with cellular substance, and have sheaths as peculiar as the femoral or carotid arteries ; each little artery, as it penetrates among the muscles, is enclosed along with its corresponding vein, and often with a small twig of a nerve, in a peculiar fascia. Aneurism produced by the bursting or laceration of an artery dilates slowly, because, the continued canal of the artery (d) is still open to the blood, the cellular substance yields very slowly, the blood coagulating in hard and firm clots at (e e) walls up the artery, and is so mixed with the first lamellæ of the cellular substance, and is so firmly clotted as to make a strong resistance. At first, while the blood is confined to its natural course, the progress of aneurism is slow. But when the cavity of the aneurism (e e) is enlarged, when the blood begins to collect there, and the circulation becomes irregular, these clots give way from time to time, and by exercise, working, or accidental excitements, there is from time to time a new impetus against the sides of the sac itself, and it enlarges ; the clots which line the cellular substance become bigger and firmer ; layer is added to layer, and at every

addition of this kind, the fluid contents of the aneurism accumulate, the open part of the bag enlarges, and the cellular sheath (f) of the artery, which in fact corresponds with the point (b) in Fig. 2d, is condensed into a firm aneurifmal sac, which gives the whole tumor sometimes the appearance of a spontaneous and natural dilatation of the artery itself. Thus there is formed a great tumor of clotted blood, furrounded with a firm cellular sac, and bounding a cavity which is continuous with the artery, where the circulation of the blood is irregular, and often accompanied with a whizzing noise.

This hard and firm tumor, rising higher and higher over the artery, begins at last to compress the canal of the artery itself; the clots sometimes loosen, fall down, and almost choke the current of the blood; the limb grows cold and benumbed, from the compression of the great trunk, and it swells and inflames from the enlargement of the inosculating arteries. By the perpetual and increasing pulsation, the pressure and straitness increase, the bones are spoiled within, and the integuments are almost destroyed without; the limb is safe, for the inosculating arteries are enlarged, yet, when the tumor bursts, the patient dies from the bursting of the main artery, and the immediate loss of blood.

Sketch explaining the Sacia of an Artery

1. The Naked Artery 2. The Sheathed Artery 3. False Aneurism



J Bell sculp

Thus we perceive that the increase of such an aneurism, where the artery is absolutely broken across, is naturally slow; that the resistance is uniformly great;

that the artery does not lie as in our preparation glasses, or on the dissecting table, insulated and unconnected, but is surrounded with cellular substance; its rupture is walled up with coagulated blood; its canal is open to the circulating fluids, and there is, for a long while, a firm pulse even in the artery which is desperately wounded, provided it be not entirely cut across*.

* EXPLANATION OF THE ETCHED PLATE.

Aneurism proceeding thus, from violence done to the artery, is very easily distinguished from that which proceeds from a natural dilatation of the tube. I have given this sheet of Etchings to explain this piece of Pathology.

In Figure 1st is seen a Femoral Artery where the dilatations are plainly of that kind which is called Natural Aneurism, the dilatation being spontaneous and gradual; and in this sketch it will be noticed, that since the profunda (a) comes off from one of the aneurismal sacs, had that sac increased so as to become a formidable aneurism, had the operation been performed, and the ligature been tied above that aneurism, the inosculating arteries communicating with the profunda would have poured their blood into the sac, and caused a secondary hæmorrhagy if the sac was cut open, or set it pulsating again, if it was left untouched.

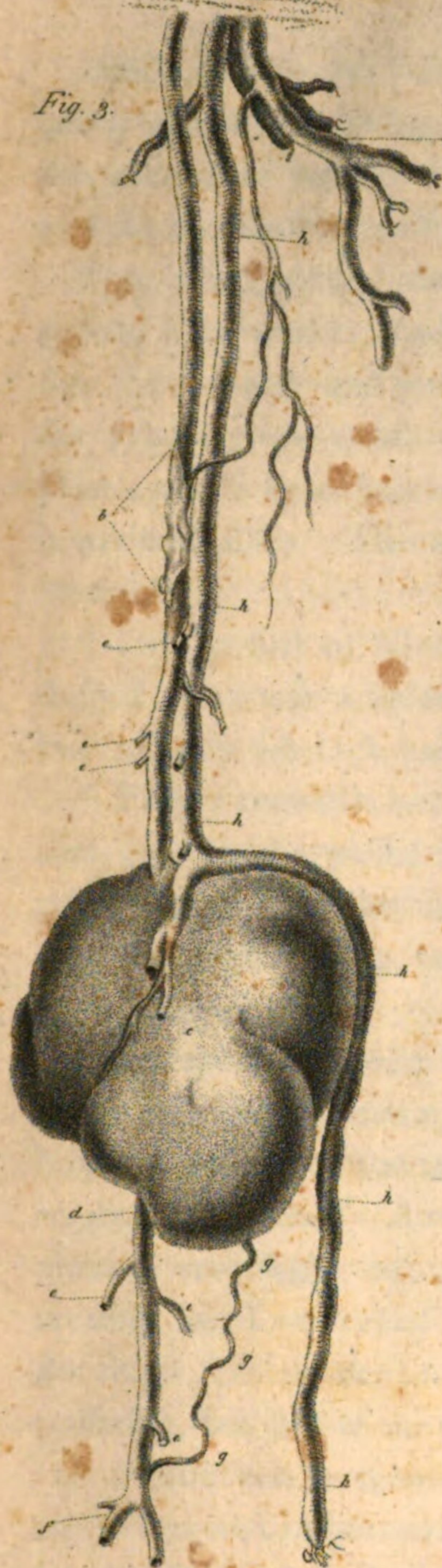
In Figure 2d you have a sketch of that Aneurism which I have been just describing, where the old woman, by her violent bending of the knee, injured the artery, and, I have very little doubt, broke it across, and left the breach in the artery sustained only by its external coat of common cellular substance.

In Figure 3d you have another sketch of an Aneurism, which was operated upon by Mr. Hunter. The man died some years after, the artery was dissected out, and the following circumstances deserve particular notice: 1st, The artery (b b) was ossified throughout the whole length of the thigh; this does not seem to have been the consequence of the operation merely, for the profunda, which was not touched by the ligature, was also ossified: therefore this man's system of arteries was predisposed to this rupture of the arterial coats, and his trade, viz. that of a hackney-coachman, exposed him to blows, twists, and strains. 2dly, The aneurismal sac (c) lay altogether upon the back of the artery; it was formed all on one side, as if the artery had given way on one side; it lay so over the artery as to press strongly upon it. "The aneurism had, in some measure, the appearance of a separate bag, it was oblong, a little flattened, and like a hen's egg, and contained a solid coagulum." 3dly, It is indeed very interesting to observe the inosculations, for we find every mark of great activity among the smaller arteries of the thigh, to supply the want of the trunk. The femoral artery is indeed obliterated in the thigh at (b b), but for some space above the aneurism as at (d), the canal is again open, and receives many inosculating arteries (e e e), and is full of blood. The popliteal artery, under the aneurismal bag, is so obliterated that the lower mouth of the artery cannot be found. At (f f) the popliteal artery becomes once more pervious, it there also receives many inosculations, by those inosculations the blood probably came down both from the profunda, along the back of the thigh, and also by shorter inosculations, joining the pervious part of the artery above the aneurism, to the continuation of the artery below the tumor; e e e marks the inosculating arteries, d marks the pervious part of the artery below the tumor, and f the division of the popliteal artery into the tibial and fibular arteries; g marks a large and curling inosculating artery, which manifestly has borne much of the force of the circulation, is greatly enlarged, and seems to have taken precedence of all the other inosculations; h h h marks the great crural vein, with its branches accompanying the artery.

Drawings of Natural Aneurisms,

Explained page 300.

Fig. 3.



Profunda Femoris

Fig. 2.

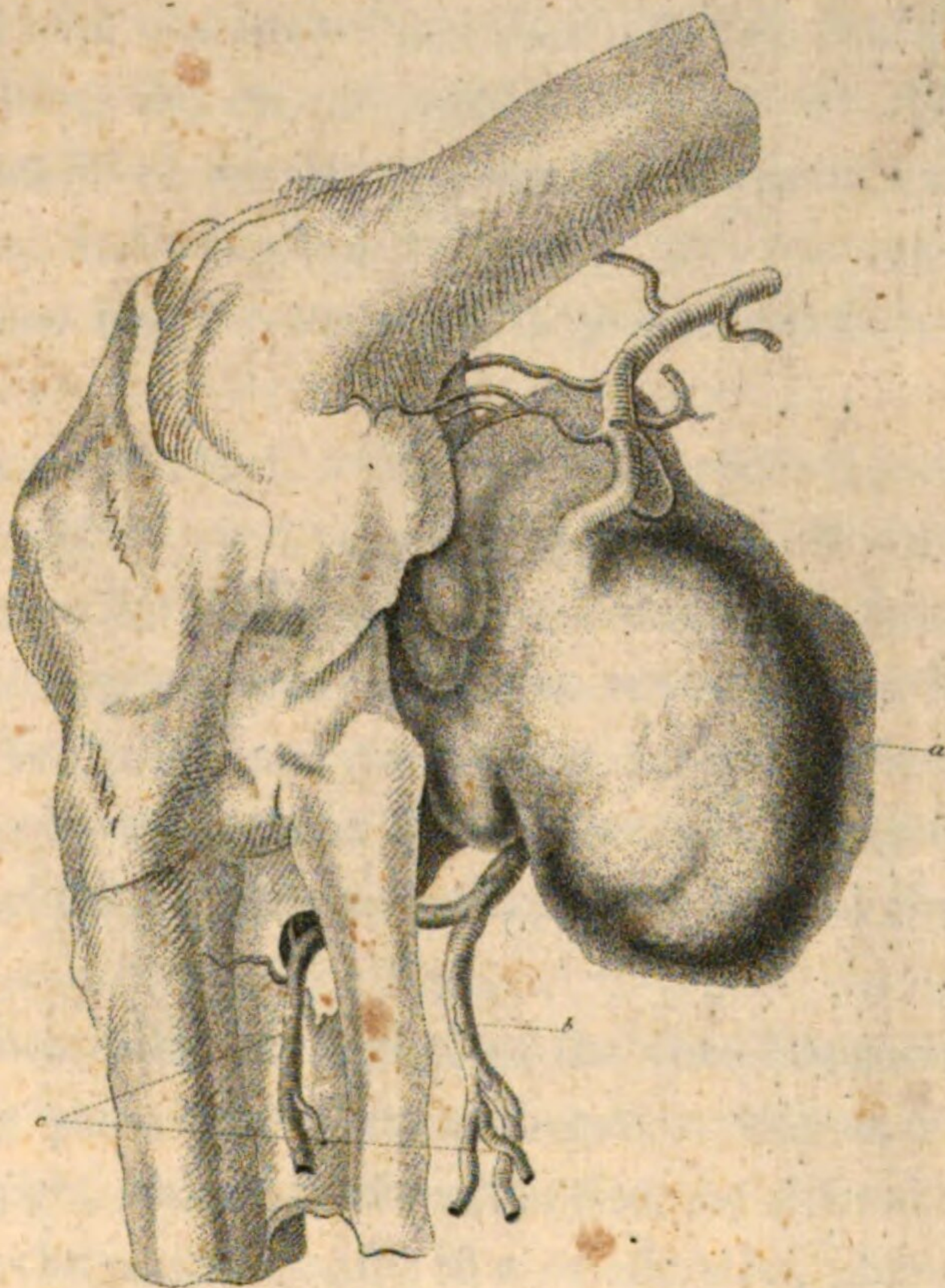


Fig. 2.

An Aneurism of the ham from Walther: a represents the Aneurismal Sac, b small Ossifications just below the dilated part, c the Tibial Arteries.

Fig. 1.



Fig. 1.

A diseased state of the Femoral Artery, where a b c represent a succession of Aneurismal Sacs, d one of those Sacs opened, and e the Profunda and its branches going off from the uppermost Aneurismal Sac.

Fig. 3.

A Popliteal Aneurism which had been operated on by M. Hunter, where the ossification which had predisposed the Artery to dilatation is seen at b. The small inosculating Arteries receiving Blood from above are marked e e. and one large inosculating branch transmitting the Blood to the Artery below is marked g.

While I relate the following case to you, you will expect, from paragraph to paragraph, a description of a dilated artery, an aneurismal sac, and a bursting of the aneurism; but the disease proceeded merely from a laceration of the artery, and the circumstances of it are of the most interesting nature.

“ A young man of about thirty-seven years of age, of a lax and delicate constitution, a tin-worker, had used this trade from his childhood, had frequent occasion, in beating and melting the tin, to remain long at the furnaces, or under ground; was much addicted to venery; had been poxed from his earliest years; was a keen hunter, and was wont to go out with the nets, regardless of hours or seasons. This man had for many years pains, which he chose to call goutty.”

“ On the first of November 1742, while straining under a load, his left foot slipped; he made a sudden effort, and tried to support himself with his right leg, but instantly felt such pain in his thigh, that he fell down and fainted.”

“ Proper remedies were applied, and though he never after walked firmly on that leg, yet he passed the spring and succeeding summer tolerably free from pain. But in the following November the disease returned, pungent pains shot along the thigh and leg, and those which passed from the ham to the foot were peculiarly severe.”

“ An apothecary who was called in, prescribed the usual fomentations and ointments for this excruciating pain; but when he began to observe a firm tumor above the middle of the thigh, and of considerable size, he desired that a surgeon might be consulted: But the patient consulted a priest, who, esteeming the complaint a very slight one, promised to cure him. The disease (says Guattani) increased, and I was called to visit him on the 12th of November. Upon examining the thigh, I found the tumor or hardness prominent, circumscribed, irregular, and pulsating, but still of the natural colour of the skin.”

“ I could not be ignorant that this was an aneurism; I straightway explained the nature and importance of this disease, advised that some other surgeons should be consulted, prescribed a regimen, and applied simple ointment to the tumor. The celebrated Joannes Victorius Masini, my ancient and respected master was called, who, agreeing with me entirely, ordered the bowels to be emptied, and some blood to be taken from the arm; his directions were immediately fulfilled, the whole thigh being at the same time anointed with ointment of roses and althea.”

You will notice now the commencement of one of the most extraordinary appearances in aneurism that has ever been related; for at this period the aneurism burst out among the cellular substance; and, by successive impulses, burst again and again, with a sense of laceration from time to time, during the night.

“ On the 15th of November, about three in the morning, the pain became exceedingly violent, and before four, the whole thigh was swelled, with such increase of pulsation and pain, that the man was in torture. At four in the morning, he felt suddenly as if something had burst in the most prominent part of the thigh; it seemed to him like the splitting and tearing of new cloth; along with this sensation came on excruciating pain, which raged for a full hour. At nine he felt, in the same spot, a second yielding and sense of laceration, slighter than the first, accompanied with a slight degree of pain, which soon subsided, and at the distance of four hours more, he felt the same sensation a third time, but slighter than either of the former.”

“ In the morning (says Guattani) I was informed of these circumstances; I found the thigh swelled to twice its natural thickness, with a painful distension of the limb, and such hardness as entirely prevented the pulsation.”

“ On the 19th of November, soon after my morning visit, he fell into such excruciating agonies, that his attendants thought him expiring; but in an hour after his pain was remarkably abated. Towards evening I could perceive that the upper tumor had extended four inches upwards, towards the origin of the Sartorius Rectus and Vastus Internus muscles, with tension and distinct pulsation, and I apprehended that, besides blood, it contained no small quantity of air.”

“ The next day he was indeed somewhat relieved of the pain, but was extremely weak, wherefore I ordered them to administer extreme unction, applied a mash of leeks and vinegar to the tumor, but, though this application had its effect, the pains, after some hours increased; the patient, of his own accord, had recourse again to the softening ointments, but without effect; he continued during the night pained and delirious, and frequently imagined that he felt something rising from his thigh to his heart.”

“ The next morning, tho' his pain was less, his pulse was sunk, his face was death-like; and, after some tremulous motions of the limb, and slight convulsions of the whole body, he expired.”

“ On opening the abdomen, I found the ilium considerably inflamed; I then dissected the artery backwards, along the haunch bone, to the ligament of the

thigh, and cleared it of the gangrenous peritoneum, with which it was covered; and then laying open the femoral ligament and the teguments of the groin, I continued to dissect along the course of the artery, clearing it of the surrounding parts, till I arrived at the tumor, which was but a very little below the groin. After dissecting the tumor carefully, I found it to consist of grumous blood, to the amount of three pounds and a half. This extravasation lay in the interstice of the muscles, in the bed of the great vessels. It separated the sartorius and triceps from the Rectus Cruris, and extended along the whole thigh from the groin to the knee. This blood being cleared away, the artery appeared lacerated nearly to the extent of two inches."

"This dissection fully accounts for the patient's death; but how an artery, not subject to great extension, and thus safely and softly lodged, should be so easily broken, we cannot so readily understand. To resolve this difficulty, I continued my dissection along the artery; I found it perfectly sound for two inches, and then it expanded into a second tumor, of the size of an egg; and, upon opening this aneurism, I found the blood so fairly coagulated in it, as entirely to prevent the passage of the blood through it." This blood being now cleared away, it appeared, that in this aneurism the coats of the artery were eroded in two places; in the one place, all the coats were eroded except the external; in the other, the erosion did not go so deep; betwixt these two places, there stood up, a septum, or partition, which served as a sort of valve. The internal coat of the artery, where it approached the aneurismal parts, and also the internal membrane of the aneurismal sac, was separated into various laminae, as if it had been touched with some corrugating liquor, which gave me an excellent opportunity of observing the fleshy fibres of the muscular coat, so rarely seen."

"Thus it appears, that the obstruction in the lower aneurismal sac caused the bursting of the upper one; and the occasional ease or difficulty with which the blood passed along the lateral branches to the muscles, may account for the successive bursters."

"These things being noticed, let us consider (says Guattani) the posture of a man straining under a heavy weight, slipping one foot, and striving to support himself upon the other! let us see what would happen. The Tendo Achillis is tense, the Gastrocnemii muscles are in full action, so also is the Triceps through the tendon of which the artery passes; and the tension of the triceps, by straitening its tendon, must compress the artery, hindering the blood from moving

freely downwards in it. The aorta and iliac vessels are strongly compressed by the abdominal muscles and femoral ligaments. The blood thus detained in the middle portion of the artery must greatly distend, and force its sides so that they will not easily recover after this pressure is removed, especially when the arterial system is weak, as in this man it was, by a constitution naturally delicate, in consequence of frequent diseases, and the exercise of a trying profession."

"This aneurism (says Guattani) proves, if I argue correctly, that whenever the blood of the main artery is obstructed, it passes along the inosculating branches; and in this case there is reason to believe, that the obstruction had been a cause of bursting too sudden to allow of the gradual enlargement of the inosculating arteries."

The whole theory of this important case rests upon the facts. From this history of the dissection we are referred to the plate, which I have copied below. Instead of that aneurismal dilatation and great septum or partition which we almost expect, we find a drawing of a plain, undilated, lacerated, and rugged artery. The whole drawing represents but six inches of the artery, and the diseased part is so small that there is plainly no room for any remarkable aneurism, especially for two aneurismal sacs.

Guattani's Drawing



The Valve-like Membrane

The artery is of its natural diameter (as the author indeed declares) both above the disease and betwixt the two aneurismal dilatations. There is no large aneurismal sac, nor any thing which should indicate that there had been a great enlargement of the artery. There is that thickening of the arterial coats which is so frequent in advanced years; there is a separation of the coats, and a slight dilatation, which indicates the predisposition to disease; but there is no aneurism

dilated to bursting; there is no natural aneurism converted by bursting into false aneurism. The previous dilatation was such only (Guattani himself acknowledges it) as might predispose to laceration; but the actual violence was a laceration of two inches in length, and Guattani plainly attributes that laceration to the pressure of the muscles, and to the sudden strain, which happened a whole year previous to the fatal termination of the disease.

On the authority of Guattani himself, I repeat this as a remarkable example of an artery yielding directly under the strong action of the muscles; and I desire you to observe, 1st, How well this great artery is supported by its cellular substance, and how slowly it overcomes the resistance of its own sheath; for had this been a natural aneurism, dilating slowly for a year, and bursting then by mere extension, the appearances on dissection would have been very singular. 2d, You will remark, how, when the sheath bursts, and the closer cellular substance which immediately surrounds the artery is torn! the blood escaping among the muscles tears the cellular substance in the interstices of the muscles from time to time with successive lacerations and successive injections of blood. 3d, How the limb is supported by the main artery while its sheath continues firm, and while the blood is confined to the natural channel. And here also I must remind you that this case is an additional proof of the limb surviving the total bursting of the artery supported by the anastomosing arteries, not only against this loss of its main artery, but also in spite of the oppression of extravasated blood injected among the muscles, and swelling up the whole limb, and oppressing it to such a degree, as entirely to prevent the pulse of the aneurism.

And yet there may be a sort of misgiving in your mind, that this was not a bursting of the artery; that the strain caused some injury, which injury might bring on disease and dilatation of the vessel; while the sense of inward lacerations in the last days of this man's life might be nothing more than the giving way of the vessel thus dilated. But I will remove all such doubts, by demonstrating to you that the artery is actually ruptured by the strain, and that the progress of the disease, the time of its enlargement, or the degree of extravasation, depend altogether on the manner in which the artery is ruptured, or on the exertions of the limb; for it is the occasional exertion that causes those inward hæmorrhages by which the aneurism is from time to time enlarged.

"A man of about thirty-four years of age was taken in the last week of April with a cramp, a little below his ham, which was followed by an immediate swell-

ing of the calf of the leg, attended with excessive pain, and it continued in much the same state for about three months, when the pain began to increase, and the swelling to enlarge. The whole leg was exceedingly tense, but there was not the least pulsation to be discovered in it, nor the least visible discolouration of the integuments. However, from the deepness of its situation, as well as from the sudden enlargement and the violence of the pain, it was presumed to be aneurism, and on that presumption the operation for aneurism was attempted on the 15th of October."

" Upon opening the tumor, the coagulated blood appeared to have acquired a fleshy consistence, and adhered very firmly one portion to another. Upon removing it totally, the tibia and fibula were found carious, and the ruptured artery appeared just between the heads of the tibia and fibula, so that it was impracticable to tie it, or at least judged unadvisable, considering the condition of the leg."—" It was amputated above the knee upon the spot, and the patient did well *."

Here this most important fact is proved in all its circumstances. The sudden rupture of the artery, the slow growth of the tumor, the want of pulsation (which is the usual characteristic of aneurism), but above all the inevitable destruction of the bones, and the incurable nature of the disease! the ease with which the artery might have been tied at first, and the necessity of amputating the limb in the end, are important lessons. In this unfortunate case, six months had elapsed from the bursting of the artery to the final consummation of the disease; the ruptured artery appeared during the operation betwixt the heads of the tibia and fibula; and this first report must have been corrected by the dissection of this limb after it was cut off, so as to leave no question concerning this principal fact. If a cramp only of the limb could thus decidedly burst the artery, what may we not apprehend from violent strainings of the limbs, blows, and falls?

We thus perceive, that the very slow growth of an aneurism is perfectly compatible with the most desperate wound, or total laceration of a great artery; and I will farther prove to you, that every artery of the human body, great as well as small, forms its aneurism very slowly.

I have already explained, that every aneurism in the arm, when occasioned by an accident in bleeding, proceeds from a direct wound of the lancet; and moreover that the artery is in general almost entirely cut across, and yet the aneurism

* *Vide Warner's Cases in Surgery.*

of the arm grows very slowly. In one case, where the operation was performed by a gentleman, a surgeon in Leith, the artery was so entirely divided, that the two ends hung together merely by a tag. In further evidence of the arterial trunk having been entirely cut across in that case, and the course of the blood through the anastomosis established, I remarked, that the moment the ligature upon the artery was drawn, the pulse was felt distinctly in the wrist; it was, indeed, strong before the operation, and seemed to be little changed by tying the artery; yet this aneurism grew slowly; it was operated upon in the fifth week; and even then had not acquired any uncommon size, being hardly bigger than the fist.

It must not be forgotten, that the fascia of the arm, and especially over the bend of the arm, is singularly strong; that the artery lies in close contact with the fascia, is felt distinctly beating under it, and is sometimes so prominent as to appear through the skin, like the artery of the temple; that while the artery is thus superficial, so as to be exposed to laceration by blows, or even by strains, it is so closely pressed by this fascia, and so well supported by its own peculiar sheath, which lies immediately under, that its aneurism grows very slowly.

Mr. Morrell of Paris, the celebrated surgeon, was called to the neighbouring village of Corbeille to visit one Jean Baptiste Porcher, who kept the inn of St. John the Baptist. He found him with a large aneurism in the bend of the arm, ready to burst, and requiring immediate operation. But as Porcher wished to have the operation performed at his own house, Mr. Morrell, on account of his avocations in Paris, sent Saviard, a man of no less reputation, in his stead.

When Mr. Saviard arrived, the friends seemed to be anxious lest the disease should be attributed to the patient having been bled in the arm about seven weeks before by a country surgeon. They wished to have this question decided before the operation, and the judge of the village would have administered an oath to Mr. Saviard. "The oath, says Saviard, I resolutely declined; for being a sworn surgeon of Paris, the solemn oath I took on that occasion should be relevant to any occasion, and over all the district." "And though I was assured, says Saviard, of the innocence of the surgeon, from his bleeding having been performed in the cephalic vein, which takes its course high in the arm, far from the direction in which any artery could be wounded; yet I chose to defer my evidence till after the operation, both that I might represent the circumstances more expressly, and that I might hurry myself into no absurd declaration; for though the cephalic vein does usually run in a direction where there is no artery, yet there may be such a *lusus naturæ*,

since the most celebrated and creditable practitioners have acknowledged that they have pricked an artery when they thought to open only the cephalic vein *."

But all this reasoning had in truth no relation to the case. This accusation had arisen from the petulance and envy of a low and ignorant surgeon of the same village. The artery was burst, and that with a very wide laceration. "This aneurism," says Mr. Saviard, "arose suddenly, in the preceding harvest, from his own natural impetuosity; as he was driving a cart loaded with corn, it stuck deep in a slough or rutt; he hooked his right arm under the wheel to lift it out, and strained with such impatience and violence that he hurt his arm, and suddenly cried out, "My arm is broken!" The aneurismal tumor began immediately to appear in the bend of the arm, and gradually increased till no longer able to bear it, Porcher was ready to submit to any operation his surgeons might advise."

"Having screwed his tourniquet, Saviard struck his great abscess lancet into the heart of the tumor; then running it upwards he slit up the tumor, and with probe-pointed scissors he opened it downwards. Having thus opened the tumor in its whole length, he introduced his fingers, took out the coagulated blood, and letting go the tourniquet he saw the opening in the artery, which was an inch in length, with ragged edges ("don't les bords etoient tout dilacerez"). He then screwed the tourniquet again, demonstrated to the assistants that the artery was not pricked with the lancet, but fairly lacerated; and having thus exculpated the unlucky surgeon, he proceeded in his operation and tied the artery."

There is no case of aneurism in which we are more sensibly struck with the slow progress of the disease, than in wounds of the lower extremity; for if any artery should prevail over the resistance of the surrounding parts, it should be the popliteal or femoral artery; yet, when the aneurism arises from a direct wound of that great artery, the disease proceeds as slowly as in those cases where the bursting of the artery is more doubtful, viz. where the disease has arisen from a strain of the limb.

"A valet was wounded by a sabre in the lower part of the thigh close to the ham, the point of the weapon touching the popliteal artery. The outward wound healed, and there ensued a circumscribed aneurismal tumor, about the

* *Qu.* Can this be a fact which these creditable practitioners allege? Did the accident which they mention, proceed from a high forking of the humeral artery, one of the branches passing obliquely across the arm?

size of a turkey's egg, beating strongly and visibly; it increased so very slowly, that more than two months seem to have elapsed from the time of the wound before the surgeons could resolve on performing the operation." This is but a slow growth even for a natural aneurism, especially for the aneurism arising from the wound of so large an artery as this, and yet, if I be not deceived, this artery was not merely wounded, it was entirely cut across. The patient being laid flat upon his belly, Mr. Duschamps, assisted by M. M. Chopart, Pelletier, Bayer, and other eminent surgeons of Paris, made his incision upon the tumor, along the course of the artery. He first cut through the skin and cellular substance; the great nerve being then dissected, and hooked aside with the fingers of the left hand, he cut into the aneurismal sac, slit it up its whole length, turned out the clots of blood, and washed and sponged the cavity of the sac; then both the extent of the sac, and the wound in the artery, were distinctly seen. The artery was absolutely cut across, and you might even have introduced your finger into the open mouth of the artery *.

The femoral artery itself hardly forms its aneurism more rapidly than the popliteal artery did in this instance. I saw a young man whose femoral artery was wounded with a penknife. The gentleman who was first called to him, perhaps, was not aware that the blood proceeded from the great artery. The day following the aneurism began to form, but as yet the wounded artery was not so far removed from the fascia and surface of the thigh but that pure blood found its way out through the integuments, and he lost at a few strokes of the heart no less than three pounds of blood; but on the third day the coagula were so firm, the wounded artery so deeply buried under the coagulating blood, and the external wound so steadily compressed, that it healed. The aneurism then assumed its proper form of a great pulsating tumor; and it was at the distance of three weeks

* With so many circumstances of the description coinciding, I have not the smallest doubt that the artery was cut across. Whether the author means, that the wounded artery presented itself during the operation, *en bouche béante*, I am not so sure. I transcribe the passage, and leave my reader to judge for himself. For the conclusion that I mean to establish, it is enough that the artery was wounded with the sabre.

"Alors, en écartant le nerf avec les doigts de la main gauche, j'agrandis l'ouverture du sac haut et bas. Ceci fait, j'ôtai tous les caillots; je lavai et épongeai exactement tout l'intérieur du foyer: Celui-ci parfaitement à sec, j'observai son étendue et le lieu de la blessure de l'artère: elle se présentait à la vue d'une manière bien sensible; *Elle étoit entièrement coupée*, le désordre, dans cette partie, étoit tel, que l'on pouvoit facilement introduire le bout du doigt dans le lieu où l'artère avoit été coupée."

from the time of the wound that the operation was performed upon an aneurismal sac, so small and circumscribed, that the limb in general was but little swelled, and this small, circumscribed, and beating aneurism was entirely limited to the upper and fore part of the thigh.

If you look into that case related by Mr. Burchall surgeon in Manchester *, (one of the earliest cases in which the operation for femoral aneurism was performed with success,) you will find a true picture of the manner in which a great artery when wounded forms its aneurism; it grows, indeed, as slowly and as gradually almost as if the aneurism were spontaneous, i. e. from a dilatation of the arterial coats. The aneurism operated upon by Mr. Burchall happened from the following accident: Isaac Ashton, a stout healthy young man, about thirty-five years of age, was sitting in a careless way cutting a rag or flaw from the root of his nail, and the scissors, which were very sharp pointed, dropping betwixt his thighs, he suddenly clapped his knees together to catch them, and struck the points directly into his thigh, and wounded the femoral artery. The blood instantly spurted out from the wounded vessel, but the bleeding was soon stopped, and the external wound healed up in a few days. Then a small tumor formed in the thigh; it was growing larger, and was somewhat painful, when he consulted a gentleman in the country, who tried various remedies in vain. To this gentleman surely the symptoms of aneurism had not appeared very decisive, nor the tumor very formidable; but it grew gradually more painful, and increased slowly in size. The man was now sent to the town of Manchester for advice, where his disease was soon recognized as an aneurism of the femoral artery; and the operation was accordingly performed with the happiest success; but so slowly had the aneurism of this great artery increased, that the man lingered three months in the country after the accident! He was brought into the hospital at Manchester on the 28th of February; it was the 4th of March before the operation was performed, more than three months after the wound.

But where the femoral artery is not merely wounded, but entirely cut or broken across, it will no doubt form its aneurism more rapidly, perhaps in three weeks, instead of three months, as happened in a case which occurred to my friend Mr. Harkness. The patient was master of a small trading vessel belonging to Borrowstounness, a very stout athletic man, about forty years of age. Six months

* *Vide Medical Observations and Inquiries*, Vol. III. p. 106.

before he had broken his thigh bone, the fracture was healed, but had been set so clumsily, that the lower end of the broken bone projected upwards like a trochanter ! The whole weight of the body rested very obliquely upon the thigh, which was manifestly in danger from future accidents ; yet while the bones continued united, the leg was strong and serviceable.

One day, in loading some goods into his vessel, he slipped his foot, and fell ; though this limb never actually touched the ground, the callus had snapped across, the bones passed one another, and the femoral artery partly by the angle which it made over the prominent end of the broken bone, and partly by the sharpness of the bone itself, was torn almost entirely across. Even this aneurism did not increase very suddenly, and never acquired a very great size ; it formed for itself a regular sac, and moreover, when near bursting, lost its round and circumscribed form, and became flat. It is easy to imagine that an artery in these circumstances could not be well supported by its cellular substance ; for the bones had been but lately reunited by a callus, they were now broken again, and all the surrounding cellular substance destroyed ; there was already, as it were, a cavity prepared for receiving the blood of the artery ; accordingly the moment the man's foot slipped under him, he felt extreme pain from the various parts which were lacerated, and even that night the tumor began to form ! The next day the tumor was large, and pulsed very strongly, and in a few days its pulsation was so powerful as to raise the bedclothes. But from the time in which the artery began to be resisted by the thick muscles and fascia of the thigh (for the aneurism lay altogether under the belly of the vastus internus), it hardly increased in size ; it remained quite stationary for a fortnight or more ; even the pulsation, which had begun to be very powerful, was in some degree deadened by the accumulation of blood and the pressure of the surrounding parts, and somewhat reduced by the enlargement of the collateral arteries. The limb preserved its natural heat and circulation ; every thing was favourable to the bold attempt of saving a limb at once fractured in its bones, deprived of its main artery, and loaded with a great aneurism. This operation was once agreed to, but a second consultation condemned the limb to be cut off ! it was cut off, and the man died.

Thus we perceive, that even the great femoral artery, although entirely torn across, forms its aneurism but slowly. The amputation of the limb, in this case, was performed the fourth week after the fracture of the bone and bursting of the

artery, and yet the aneurism had attained but to a moderate size. The dissection of the limb, which I shall presently describe, will show, that the force of the blood condenses the surrounding cellular substance into a firm sac. The whole case, when we come to reason upon it, will be found to present to us an interesting view of the state of an aneurismal limb, and to prove the extreme danger of amputating, and the propriety of risking the operation of aneurism even in the most desperate circumstances *. But, at present, I go on to prove, that even when the aorta itself bursts, it forms its aneurism very slowly, and does not by any means prove immediately fatal.

An officer of distinction, about forty years of age, was wounded in the battle of Fontenoy, and from his long confinement to bed he fell into bad health. He was distressed during his confinement with nephritic complaints, and soon after his recovery was seized with vomiting and spitting of blood. He went to Bristol Wells, recovered his health, and continued for nearly ten years to live a careful and regular life, attentive to his exercise on horseback, to his diet, and to the quantity of wine he drank.

About ten years after these complaints he seems to have been suddenly seized with very inexplicable distress, which soon ended in his death. He began first to complain of want of rest, tenesmus, gripes, and mucous stools, streaked with blood. These symptoms were appeased by some draughts of oil, manna, and rhubarb, but the watchfulness continued. The patient felt more than usual pain in his belly, especially in the left side, he feared a return of his gravelly complaints, and about a month after this first attack he consulted Sir John Pringle. A hiccup had come on, the pain was now constant, sharp, darting to his back, groins, and testicles, it was especially severe when he turned to his right side, but he never attempted to turn upon his left. These were the decisive marks of some organic disease. The disorder was quite unaccountable. His pulse was quicker, harder, and fuller than natural. He had some degree of thirst, but his head was clear. Such was the degree of watchfulness, that for six

* Perhaps there is no case in which the slow progress of the aneurism of a great artery is more remarkable than in that of Stewart the leech-gatherer, related in the Chapter on Wounded Arteries, who was wounded with the point of a pair of scissars in the hip, and the gluteal artery was cut entirely across. He received this wound in stepping out of a boat in one of the most northerly counties in Scotland, Caithness or Ross-shire. His aneurism was in not the smallest danger of bursting when he came under my care, though he had been wounded six weeks before, and had travelled on foot and in carts more than three hundred miles.

weeks he had not been sensible of slumbering half an hour ; for the last three weeks of his life he was hardly sensible of having even closed his eyes. His feet, he observed, were sometimes benumbed, which made him call for more wine than usual ; and though he had no sickness at his stomach, his appetite was gone. He was bled, but as he grew daily weaker they were afraid to repeat the bleeding, and for his hiccup, he took musk and absorbents without effect. Opiates were not omitted ; and both on account of the hiccup, and in order to procure sleep, laudanum was given, at first in smaller doses, but his physicians were soon obliged to give it to the amount of one hundred drops during the night, without checking the hiccup, or obtaining sleep, but it raised a general perspiration. He seemed after this to be relieved ; his spirits revived, the pain ceased ; but this was the deceitful prelude to death. On the day of his death, he continued all the morning wide awake, sensible and in good spirits, but with an incessant hiccup. About four in the afternoon he called for drink, but before the servant could warm it, he suddenly expired.

The dissection of this gentleman's body proves to us a very unprecedented fact, that the aorta itself sometimes gives way ; that the aneurism which its laceration forms is hardly more rapid in its growth than that of a smaller artery ; that the sac which it forms out of the loose cellular substance is firmly attached to the artery, as if the aneurism had arisen from mere dilatation. The abdominal viscera were found, but there was a tumor larger than the fist, of an oblong figure, lying close to the spine by the side of the aorta descendens, and in the direction of that vessel. It began as high as the emulgent arteries, descended nearly to the pelvis, and was of a very firm consistence. It was found to consist of coagulated blood condensed in the cellular substance, and under the adjacent parts of the periosteum were some detached parcels of extravasation. This abdominal portion of the aorta along with its tumor, were dissected out of the body, together with a part of the thoracic aorta and of the common iliac arteries, and the middle part of the aorta being laid open through its whole length, there was observed in the space, between the emulgents and lower mesenteric arteries, a complete rupture of all its coats. The aperture had lacerated edges, was big enough to admit the point of the dissector's thumb, and led into a tumor which now appeared to be a SPURIOUS ANEURISM of the GREAT ARTERY, that is, a sac formed of the cellular membrane, containing blood of different degrees of coagulation, which apparently had issued at different times from the aorta.

The neatness of this dissection prevents all those doubts which puzzle us in

cases less correctly related ; but the case is written by Sir John Pringle, the dissection was performed by Hunter, the tumor was not first mangled, more canino, and then the connections and causes of it stated in idle conjectures. The aorta was slit up on that side which was found. The dissectors saw clearly the connection of the tumor with the artery. The artery was burst, the laceration had ragged edges preventing all suspicion of previous dilatation, the breach was such as to admit the dissector's thumb, and was proportioned to the size of the artery. The sac was formed in the cellular substance condensed in proportion to the driving of the blood, and it adhered so to the artery as to be cut out along with it, and certainly would have been reported by less dexterous dissectors, as a natural aneurism which had burst. The blood was collected by several successive extravasations ; the artery making (according to the exertions of the body) successive impulses against the cellular substance and against the peritoneum, which serves as the sheath for this vessel. For our entire satisfaction in regard to the nature of this disease, we, in another paragraph, learn also the cause, for " the aorta was not dilated above the aperture, but its coats were at that place harder than natural, as if tending to ossify, and having lost their natural elasticity and toughness, were parted asunder *."

Here then is the greatest artery of the body burst ! fairly torn asunder, and that without any strain or blow †. The greatest artery of the body, not supported like the femoral artery by a peculiar sheath, nor bedded in firm cellular substance of muscles, but merely covered by the peritoneum and lodged in the loose cellular

* " Upon the review of the whole, we conclude that a small aperture had at first been made at this weak part of the aorta, some considerable time before the death of the patient ; that the tumor had been gradually formed of the oozing of the blood into the cellular membrane surrounding the artery, and which thereupon was dilated into that sac mentioned above." Vid. Sir John Pringle's Medical Essays and Observations of Edinburgh, Vol. III.

† Mr. Else observes, That " the arteries sometimes become ruptured without any previous dilatation. I have (says this author), a preparation of the aorta ascendens, appearing in no place dilated, which exhibits two ruptures, one is small, and situated about half an inch distance from the valves, from which a coagulum was formed about the size of a large nutmeg, that was seated between the trunk of the aorta and the trunk of the pulmonary artery. From the white appearance of the coagulum, and the regularity of the edges of the rupture, it seemed to be of long standing. The other rupture is much larger, seated at the curvature between the exit of the right and left carotid arteries, the edges of which are torn and irregular, and formed a tumor, which pressing against the lower part of the trachea, and the branches of the bronchia, destroyed the patient by suffocation in less than a month from its first rise, and before there was any appearance of an external swelling.

substance of the kidney, is yet so supported as to form its aneurism very slowly. The blood is forced into the cellular substance by successive impulses. The sac is fairly circumscribed, and forms an oblong tumor not much bigger than the fist, though of considerable length, lying close to the side of the artery, and so connected with it as to be cut out along with it; well may such a sac be mistaken for that of a natural aneurism in bungling dissections! That every surgeon is able, in bloody operations in the ham or thigh, in aneurisms lying close under the heads of the gastrocnæmii muscles, to distinguish what is the sac of a true, and what of a false aneurism! what arises from the dilatation of the artery, and what from the cellular substance, is not to be believed.

Thus have I proved to you, that an artery is sometimes dilated gradually, sometimes is hurt in its coats, but very often is burst, lacerated, or entirely broken across. That after being burst, it is supported by its sheath. That the cellular substance receives the blood; while the breach in the artery thus walled up with coagula, forms its aneurism slowly; that the greatest arteries of the body form their aneurisms slowly, and have the cellular substance and arterial sheath beaten into the form of a distinct sac; and that an aneurism which truly arises from a laceration of the artery may be mistaken for a natural aneurism or simple dilatation of the tube!

CONCLUSION.—CONTAINING A DESCRIPTION OF VARIOUS ANOMALOUS CASES OF ANEURISM.

To what practical uses these speculations may be applied, you will next inquire; for, unless they have some influence on practice, your interest in them should be but very small. You will remark that no sooner is it proved to you that an artery may be burst by a strain of the limb, than you begin to look upon certain accidents which are apparently trivial, in a new and serious light. In the case of a direct wound of an artery, succeeded by a large tumor, with strong pulsation, and all the characteristic signs of pure aneurism, you can be at no loss to distinguish the nature of the disease. But too often it happens, that when this disease begins in a sprain, when the pain is great, the pulsation small, and the whole member swelled to a great size, the general swelling conceals the particular swelling of the aneurism, and

the limb is destroyed before the surgeon is aware of the nature of the disease. These are the cases which are so generally called anomalous, or, in other words, cases which are not understood. The surgeon is unwilling to believe that an artery is burst by a strain of the limb, just as a hernia is forced down by any sudden exertion; and while the surgeon remains ignorant of the nature of the disease, the artery is actually burst, and is pouring out its blood among the muscles; the bones are corrupted, the joint too is presently destroyed, the whole limb is ruined in its texture, swelled, cold, and lifeless. The surgeon cuts it off, and being as little expert in anatomy as judicious in surgery, he, upon finding bones, blood, and matter mixed in one confused mass, learns by his dissection nothing more than he did by his previous inquiries; he calls it an anomalous case! a poor apology this word anomalous, for ignorance, which has cost the patient a limb. But these are not the less aneurisms, because of our being ignorant of their nature and origin, and of that process by which they come to this last stage of irregular suppuration.

This compression of the soft parts, this caries of the bones, and destruction of the joint; this mixture of blood and matter; this confusion of aneurism, caries, and abscess, with a putrid fluid, like coffee-grounds, and a surface nearly gangrenous, is indeed the final termination of every neglected aneurism; but there are certain occasions in which the disease infallibly assumes this form. First, Wherever the aneurism is produced by a broken bone, for there the artery is wounded or broken on the side next the bone, the blood is poured out under the bellies of all the muscles, the resistance to its outward extension is great, and the inward destruction of parts is proportionably rapid. Secondly, When the aneurism happens in the ham, or under the bellies of the gastrocnæmii muscles, for there the aneurism is peculiarly straitened, it is pent up betwixt the ham-string tendons, it forms slowly, is singularly hard, and frequently has neither the pulsation nor other marks of aneurism; but the knee joint being destroyed, the bones corrupted, and the limb enormously swelled, is fit for amputation long before the tumor threatens to burst! even amputation is not safe! Thirdly, But most of all, the limb is in danger when the case is not understood; when the artery is not wounded, nor gradually dilated, but actually burst; for the surgeon, little accustomed to think of this bursting of an artery, never apprehends the true nature of the complaint, nor even knows it for aneurism! After having amputated the limb, his exculpation consists in calling it an anomalous case, intimating that it was unintelligible and incurable.

OF ANEURISM FROM FRACTURE OF THE BONES.

Aneurism, from fracture of the bones, is more or less important according to the artery that is wounded, and the other circumstances of the case. In a fracture near the ankle, the artery is small, the aneurism superficial, the resistance outwardly is slight, whence the bones within are proportionably less endangered. In such aneurism behind the ankle, in the Fibular Artery, for example, the tumor should be opened, the artery tied, and then the bones reunite, but till you have tied up the artery, you have in general no reunion of the bones. We find that this aneurism also grows very slowly, in so much that sometimes it hardly appears till after the callus is formed, and the patient begins to walk. There are indeed exceptions to the general rule, for the fracture sometimes heals while the aneurism goes on. "A surgeon of Guand, being called to set a broken leg, applied the usual bandages, and in the usual time accomplished the cure. But when the young man began to walk abroad, a tumor was observed behind the ankle, over the place where the bones had been broken, the surgeon (now called again) being ignorant of the nature of the disease, applied a caustic, but when he opened the eschar, instead of matter which he expected, blood gushed out so impetuously, that it was stopped with great difficulty. The young man fainted in the moment of this hæmorrhagy, and expired in two days after *."

When the artery is of another order, larger and lying deep among the muscular flesh close upon the bone by which it has been lacerated, the case is more unfortunate, and if neglected, too frequently terminates in mortification and death. The tumor caused by such an artery is large and diffused, the coagula of blood which oppress the limb are very large, and consequently the pulsation is not distinct and smart, but heavy and throbbing. Knowing, as you do, the principles of surgery, you need not be informed, that before the pulsation can destroy the muscles or make its way through the skin, the bones must be irrecoverably carious, and the soft parts round them destroyed by extravasated blood. That if the oppression be allowed to increase, the limb will fall into gangrene, or the skin burst and the patient bleed to death. And you must be sensible, that if the skin be left to burst from this gangrene, you must then search for the artery and tie

* Palfin, Page 341. This is a rare exception to the general rule, that such complicated fracture cannot heal till after the artery is tied. In this case, probably, the artery had formed a small sac for itself, distinct from the lacerated cavity formed by the fractured bones.

it, with but a poor chance of success, the extravasation having quite ruined the texture of the limb. If again the oppression be allowed to increase till the limb become generally swelled, cold, lifeless, and in danger of gangrene, you must cut it off, without perhaps the consolation of saving even the patient's life, for such a limb is apt to run into gangrene.

When an artery, then, is thus lacerated, along with fracture of the bones, you have but this alternative to cut the limb off at once, if it be very desperately wounded, or to try to save it by making incisions (as in simple aneurism), and tying the artery! If you call a consultation, it is not to decide so clear a point, but to satisfy the friends and exonerate yourself. The fracture is already complicated with aneurism, and you are under the dangerous necessity of converting this complicated aneurism into a compound fracture! You apply your tourniquet, make a long and deep incision, turn out the coagula of blood with your fingers, cleanse the sac with sponges, search for the artery and tie it up. You wash out the blood from the sac with syringes and sponges, for while it lies betwixt the bones they cannot unite; what blood you are forced to leave melts down into bad matter and flows off; the deeper parts of the wound gradually digest, granulate, and fill up with soft flesh; and when the continuity of the parts is thus restored, the new bone or callus begins to form. Such is the activity of a wounded artery in forming its aneurism and destroying the surrounding parts, and so complicated is the disorder when a wounded artery is added to a fractured bone, that unless these operations are performed early, the limb is inevitably lost.

But when the main artery of the limb is wounded, the aneurism often forms very slowly, and the blood being effused under the great muscles of the limb, the pulsation is very indistinct. In one place firm coagula, together with the injection of the cellular substance makes the tumor hard and firm, and there the pulsation is not felt; but in another part, the walls of the tumor, in the interstices of the extended muscles, are thin, and there pulsation is perceived. The whole integuments of the limb inflame and thicken with effusion into the cellular substance, so that the nature of the disease is very uncertain, the case is misunderstood, the parts are left to suffer all those changes which the accidents of the case may induce.

During the progress of this effusion, the inosculating arteries are enlarged, ensuring the safety of the limb, and adding force to the other proofs of aneurism being seldom fatal from absolute gangrene; while the bone itself undergoes changes much more remarkable than those of the soft parts. Of these changes,

I know none more singular than that kind of exostosis which exudes as it were from the bone, forming sometimes a large and regular cavity, or branching out into the most irregular shapes. When a bone is broken and the great artery wounded, the blood is extravasated betwixt the ends of the bone. The aneurism is formed within the lacerated periosteum, the fracture becomes a part of the aneurismal sac, the internal parts of the system of the bone cannot reunite, and granules and splinters of bone are accordingly found, at a great distance of time, floating loose, as if half dissolved in the aneurismal blood, while the ends of the broken bones remain rough.

But the condition of the periosteum must chiefly be regarded, for being part of the system of the broken bone, it is capable of generating new bone, and the form of that bone will be regulated by the parts upon which it may be moulded. The periosteum being now expanded into the form of a cyst over the broken bone and aneurismal blood, its new secretion of bone will spread over the aneurism. The outside of the periosteum is still connected with the muscles and other soft parts, it is nourished and receives its vessels from without, and lives, and thickens, and begins a secretion of bone. The secretion while it is in this unnatural extended condition is very powerful, and the bone which is formed by this dilated or expanded periosteum, is not only firm, but broad like a scull. We often see the lacerated periosteum and the membranes of fractured and luxated joints, or of carious bones, forming great bony caries or stalactitic-like projections. In gun-shot wounds, with fractures of the upper part of the thigh bone, in the scrophulous caries of the hip joint, in luxations of the thigh bone from the acetabulum, in fractures of the cervix femoris, in compound fractures and luxations of the wrist, and in fractures of the shoulder bone, bony cavities are often formed as big as the head of a new born child. In cases of aneurism, it is more difficult for the periosteum to live, or to form those bony cavities, but when such cavities are formed, they are filled with blood like coffee-grounds, and constitute a most irregular, or as it has been termed, anomalous disease; and round the outside of such bony cavities go the enlarged branches of the artery, which preserve the limb notwithstanding of all this disorder. It is in such cases that we are almost at a loss to say, whether aneurism or exostosis has most share in forming this fatal tumor.

I shall illustrate this species of mixed aneurism, by relating a case which was communicated to me two years ago by my friend Dr. Jeffry professor of ana-

tomy in Glasgow, whose abilities and zeal are universally known *. Dr. Jeffry had the goodness to send me along with the preparation, from which I have made these drawings, the following short narrative of the case :

“ An old woman of about fifty years of age was rode down in the streets by a cart, and her arm broken in two places. One of those fractures was about two inches above the elbow, the other was above the middle of the arm, and the whole bone was greatly shattered ; yet this poor creature had no assistance, no surgeon was called, the arm remained unattended to for six weeks, when Mr. Parlane, a surgeon in Glasgow, visited her and found the arm greatly swelled, so that he could neither distinctly understand the nature of the injury nor the condition of the bone ; it was presumed that there was a fracture, and the patient was laid in a posture favourable to the reunion of the bone.”

“ The tumor never subsided but increased, occupied the whole arm from the elbow to the top of the shoulder ; pulsation was distinctly felt at the top of the shoulder, but of such a kind as might proceed from some artery near the surface, it was judged to be really so, the idea of an aneurism certainly had never struck the gentleman who attended her, for he opened the tumor which was soft and fluctuating, there was no doubt of its containing a fluid of some kind or other ; the lancet was struck into it, but instead of matter, as was expected, blood flowed in a full stream.”

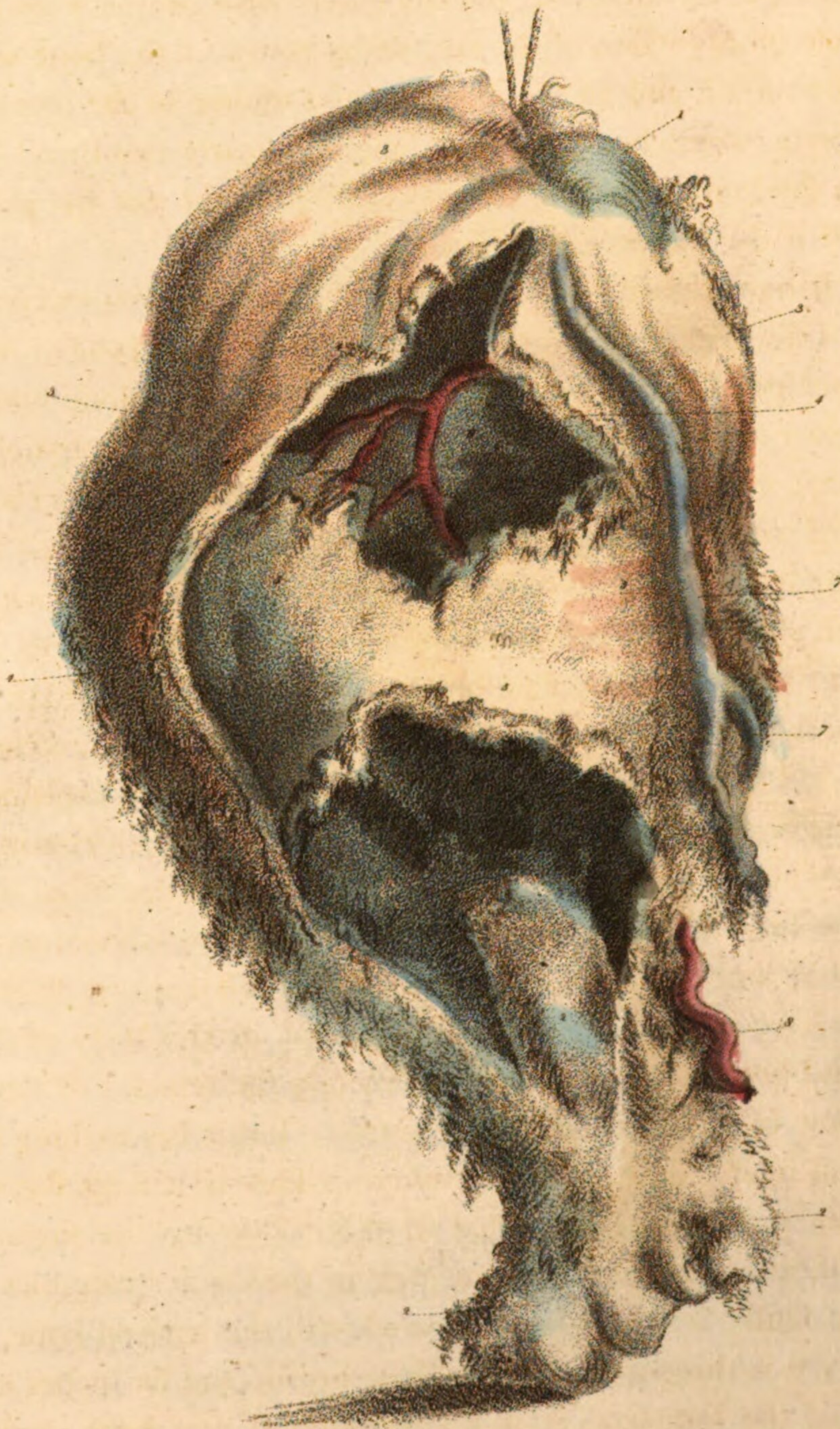
“ This puncture healed up easily, the tumor which had subsided when it was thus imprudently opened, soon filled up again to its full size, and the hand and fore arm became œdematous and cold. In this condition the patient survived five months, the tumor pulsating manifestly, especially in its upper part ; but how this woman died, or after what kind of sufferings, is not related in the case.”

“ On opening the body after death, eight months and more having elapsed from the time of the fracture, a profusion of mixed and putrid blood like coffee-grounds was discharged. Two inches of the lower part of the bone retained its natural form, all the middle part of the bone was destroyed, the head only remained on the upper part of the tumor, but with its cancelli quite eroded, no-

* It is not natural to mention a friend of Dr. Jeffry's rank in our profession, without some marked testimony of respect and attachment. Yet I will not presume to express in this note, the sentiments I feel towards Dr. Jeffry, whose name should rather have appeared in the most distinguished and respectful place in my book.

*First Drawing of Aneurism, with extensive ossifications within the
Aneurismal Sac.*

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6 The Arteria Circumflexa humeri encircling the Sac within.

8 The Tortuous and enlarged branch of the humeral Artery by which the Arm was supported.

thing being left but the mere shell. Through the whole length of the bone, the cancelli were completely dissolved, and the outer bony lamina were found adhering to the whole inner surface of the sac, many pieces of the bone were found in the heart of the tumor, and on the fore part and middle of the tumor was found, one piece of bone two inches and a half long and nearly two broad."

"Although the humeral artery was injected, it could not be perceived from what branch of it the tumor was produced."

By turning now to the two drawings of this diseased arm, you will understand the whole nature of the disease. In Number First are seen, 1. the head of the os humeri, and, 2. the lower part of the bone, with the condyles; these alone remained, while all the rest of the bone was destroyed by caries or (as the older physiologists would have expressed it), melted down among the aneurismal blood: 3. is the great aneurismal sac, and it will now be understood how the periosteum formed the outer sac of the aneurism; how the blood (for this immense cavity was filled with blood) occupied the place of the callus, prevented the reunion of both fractures, and kept the whole length of the bone in that state of caries by which it was at last entirely annihilated: 4. marks the thickness of the sac, the adhesion of the muscles to the outside of the sac, and thus the manner of its nourishment is to be explained! The periosteum was thus the only part of the system of the bone which continued to live; and being everywhere supported on its outer surface by the usual concurrence of vessels from the surrounding parts, we have no reason to wonder at its continuing to secrete bone among the lamellæ of its own substance: 5. shows the ossification which I have just explained; it is described in the body of the case as if this large flat and broad piece of bone were merely the remains of the os humeri, unfolded somehow by the extension of the tumor; but it has nothing in common with a cylindrical bone, such as the os humeri. This is a large flat ossification, generated by the periosteum, supported in this action by the surrounding soft parts. This ossification is a fourth of an inch in thickness, resembles one of the flat bones of the skull; it might be compared with the parietal bone, but that it is much thicker; it is three inches and a half broad, and six inches long. This is no expansion of the humerus, it is a generation of new bone, and of a very singular size; nor is this the only bone that has been formed by this diseased periosteum; on the contrary, the whole of the aneurismal sac is lined with bones, or in the very few places where the sac is still soft, you feel it beginning to harden with specks and spots of ossification within the centre of the mem-

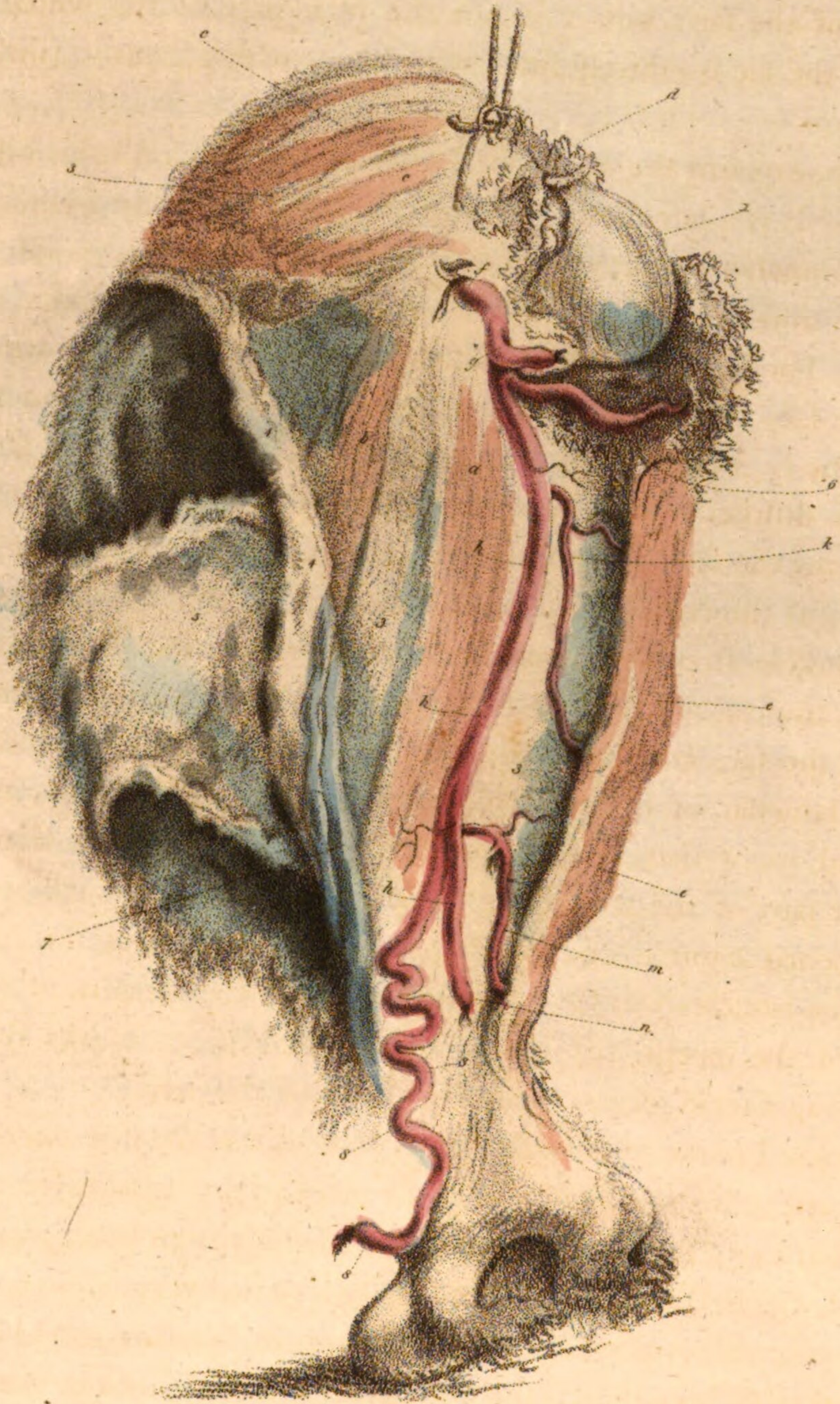
branes. This piece of bone, marked 5 5, is indeed the thickest and strongest part of the bone, and has been laid entirely bare by the dissecting away of the fore part of the sac; but it is not the fifth part of the whole quantity of the bone; for the sac is entirely lined with bone, which gives it this stiff balloon-like shape.

Figure 2. explains the aneurifmal arteries, by which all this disorder had been produced. It is a lateral view of the arm, and shows the humeral artery and its enlarged branches bending round the inner side of the tumor. 1. and 2. mark the upper and lower parts of the os humeri, the only parts of the bone that remains. The head, 1. has its cancelli destroyed; it is, as it were, laid upon the top of the sac, upon introducing your finger from within, you feel that the head of the bone is a mere shell: 3. marks the outer surface of the great sac; and now it is distinctly seen how the periosteum and thickened cellular substance which forms the sac, is supported by the muscles which lie over it. In this view are seen, (a) the coraco brachialis muscle, (b) part of the biceps, and (c) the deltoid muscle stretched upon the surface of the sac, expanding along with it, and these muscles are thin in their fibres, but still healthy: 4. shows the thickened edges of the sac, and the manner in which the periosteum and the muscles form the two lamellæ of the sac: 5. shows the great ossification, nearly four inches broad and more than five inches long; for in the second figure 5. you see only the lower part of the same firm piece of bone. At (d) are seen the remains of the thickened capsule and other parts which surround the head of the bone; and of the muscles you see in this drawing (a) the remains of the coraco brachialis, (b) of the biceps, (c) of the deltoid muscle, (e) marks the triceps extensor cubiti lying flaccid all along the back part of the arm.

And now I come to describe the system of the diseased arteries: (f) marks the axillary artery injected, and tied at the place where it begins to assume the name of brachial artery; here it gives off the branches which belong to the scapula and to the joint, (g) is the great sub-scapular artery tied very close to the trunk. 6. is the arteria circumflexa humeri, so named from its bending round the joint; and here it is marked 6. because it is the same artery which is seen in the first drawing bending round the inner surface of the sac. (h) is the continued trunk of the brachial artery. (i) a small muscular branch. (k) the profunda humeri superior, or upper muscular artery of the arm, the muscular spiral branch of which goes in a spiral form under the belly (e) of the triceps muscle. (l) is the place where the humeral artery

Second Drawing of an Aneurism with extensive ossifications within the Aneurismal Sac.

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seems to divide into two branches of equal size, and seems as if there had been in this case a high forking of the humeral artery, but, to a pathologist, the original trunk and the enlarged inosculating artery are easily distinguishable; for (h), the continued trunk of the humeral artery, though partaking equally of the injection with the other trunk, is lank and straight, while the enlarged inosculating artery is remarkably tortuous. 8. then, as was seen in the first drawing, is known to be the enlarged inosculating artery, first, by the direction in which it comes off from the main artery, viz. nearer the bone; secondly, by the part of the arm at which it comes off, demonstrating it to be the branch named Profunda Inferior; thirdly, by its tortuous form, which shows it to have been enlarged; fourthly, by its place, for in the preparation it is tied down firmly to the inner condyle of the shoulder bone. This proves clearly, that though this has the appearance of a division of the trunk, it never could have crossed the bend of the arm at the place of bleeding, it is merely the enlarged inosculating branch of the profunda inferior, of which a small branch (m) is seen going in under the triceps muscle, just as the branches of the profunda superior do. 7. is the great basilic vein bending over the tumor, and which is seen also in the other drawing.

We need but to review in the history of this case, a few circumstances in order to understand the whole disease in the most unequivocal manner. First, The sudden rising of the tumor, the swelling of the whole arm, the fluctuation, the pulsation in the upper part of the tumor, prove, that though the chief part of the tumor is found upon dissection to be bony, yet aneurism, and not exostosis, formed the basis of the disease. Secondly, The striking of the lancet into the tumor shows, that there was blood very early; the sudden filling up of the tumor to its full size, after having been punctured with the lancet, shows that the artery was open at that time, and throwing its blood freely into the sac; and finally, the bony cavity being filled at the time of death with nothing but corrupted blood, which always after long delay assumes the appearance of coffee-grounds, proves the tumor to be merely an aneurism! but it is a complicated aneurism, it is combined with a fractured bone; and the condition of the periosteum accounts for the generation of such extensive plates of bone, equal to a cranium in size, and something like it in the breadth and flatness of the ossifications. Thirdly, It being proved that the disease was aneurism, it is next to be observed, that there is not belonging to the humeral artery, as to the femoral, a great profunda, or collateral branch, as large as the trunk itself; there are but two muscular branches in the arm, and those not larger than

crow quills ; there is no artery except the trunk itself equal to the production of such an aneurism. The branches which run on the inner surface of this tumor, as at figure 6. are all singularly well injected, which shows that none of these had any share in producing the aneurism ; and surely none of them had terminated in the bag ; even the force of the injection had not burst their most delicate branches ; they were full of the injection, and the bag empty. While the entireness of these branches proves that they had no share in forming the aneurism, the enlargement of the profunda inferior, 8. to such a size as to rival the trunk itself in diameter, is another proof that the trunk was wounded below the point (n) where it is tied, for nothing but the wound of the trunk (h) could thus enlarge the profunda.

This is one of those cases in which, as I have expressed myself, one is almost at a loss to decide, whether aneurism or exostosis has the greater share in forming the disease. The confusion of the case is almost an apology for any mistake of the surgeon ; yet the suddenness of the tumor, the pulsation, the blood following the lancet, were signs too conclusive to allow of any doubt. There must have been in a certain stage of this case such œdema, oppression, coldness of the limb, and suppression of the pulse, as might have intimated to the surgeon that the change in the state of the circulation had taken place, on which the fate of such a limb depends. The patient living with an aneurism certainly proceeding from the rupture of the great artery ; living also under such a complicated and oppressive disorder, fracture, exostosis, and extravasated blood, proves to us that there is hardly any case in which we need despair ; and the enlargement of all the arteries in this limb, is authority for performing the operation for aneurism, even when the main artery is ruptured, along with a fracture of the bone.

A limb, from this combination of fracture and aneurism, often falls into such disorder that it is cut off, the surgeon himself not knowing why. The etching, No. 5. which is put upon the same sheet with the etchings of Mr. Harkness's aneurism, is the arm of a man whose leg was cut off in a public Infirmary in this country, but his case was very imperfectly recorded : " The disease was a compound fracture ; the tibia and fibula were fractured obliquely near the heads of the bones, and were much splintered ; the limb swelled immensely after the accident ; but though the limb was set, and the bones replaced, the swelling did not as usual subside, but, on the contrary, it was discovered a few days after, that the tumor was of a fluid nature. It was punctured with the lancet, but no-

thing issued except grumous blood, and the probe went down into a large cavity filled with coagula. It was now resolved to open the tumor very freely, and many large coagula of blood were taken out. The tumor being thus cleared of its contents, a large deep-seated artery sprung, and the leg was immediately cut off."

This is the usual short process: the surgeons had gone too far in digging into the centre of a disease which they did not understand; when they took out the coagula, they might have expected florid blood! but their hurry and alarm prevented any consultation on the case, and they cut off the limb. Yet, however rash we may think this operation, it was at all events better to look into the disease thus early, and cut off the limb, than leave the aneurism to make the bones carious, and destroy the joint. In looking on the sketch we perceive, that the fibula is broken near its head, and has a large splinter (a), which has torn the artery at (b). We perceive, that this hole in the artery is just at the forking of the main artery into the tibial and fibular arteries; we are sensible, that such a wound is equal to a total rupture of the main artery; and since this man's limb continued thus to survive the loss of its arterial trunk, since we also find the articular artery (c), and the curling muscular branch of gastrocnæmii (d), considerably enlarged, we have every reason to believe, that had the artery, when it thus threw out its blood, been simply tied, the issue of the operation would have been fortunate.

This brings us naturally to the second cause of this anomalous form of the aneurism, viz. its being confined within the narrow cavity of the ham.

PECULIARITIES OF POPLITEAL ANEURISM.

In all cases of neglected aneurism, this destruction of the soft parts, and caries of the bones, is the last stage of the disease. But in popliteal aneurism, whether proceeding from spontaneous dilatation of the artery, or arising from strains, fractures or wounds, the danger is peculiar; for the aneurism is so confined under the bellies of the gastrocnæmii muscles, and betwixt the tendons of the hamstrings, that the resistance to its extension is very great, the destruction within is proportionably rapid, and the disease is always attended with severe pain.

The popliteal artery bends over the condyles of the thigh bone, passes behind the knee joint, and is affected by every motion of the joint. It also lies under the gastrocnæmii muscles, whence it is endangered by every strain of a limb

which is very powerful, and which continually supports the whole weight of the body. The disease, when it happens in the ham, corresponds but too well with the theory we have laid down ; it is produced merely by a strain, and ends often in total destruction of all the adjacent parts. A man, for example, has a fall from his horse and hurts his ham, or strains it in mounting his horse ; or his limb falls in betwixt the rounds of a ladder, and is violently and suddenly bent ; or he receives a blow upon the ham, or he takes a sudden cramp in the calf of his leg, and from that moment his pains and lameness begin. Whether the artery be merely stretched, racked and inflamed, or whether it absolutely give way and bursts under such accidents, is little to the present purpose, but thus it is that the disease begins, and is long unsuspected by the surgeon, while the patient walks, or refrains from walking, by fits, as the pain happens to be more or less violent, rubbing the part perhaps with camphorated oil.

Thus all parties continue indifferent to one of the most fatal diseases. The ham is straitened, whence the tumor, even from the first, is of a stony hardness. From this straitness it loses very early the marks of aneurism, for the pulsation often ceases, or is very obscure. The tumor (even in natural aneurism of the ham) is not always clearly circumscribed, nor to be fairly traced to any connection with the artery ; and being covered, and its pulse suppressed by the great thickness of the muscles and skin, the nature of the disease remains unknown. From the same pressure the leg becomes very early cold and oedematous ; for the veins, lymphatics and artery, all pass in this straitened cavity of the ham, the pressure upon these produces a general swelling of the limb, and the general swelling conceals the particular tumor. From the elevation of the bellies of the gastrocnæmii muscles over the tumor, and from the distension of the ham-string muscles, the limb is thrown into severe and painful cramps ; and from the nerve passing over the tumor (pressed sometimes quite flat), a very distressing numbness is always felt, and the lameness and pain are such as the external swelling cannot account for. All these distresses of pain, cramps, swelling, and general numbness of the limb increasing every day, the patient sometimes dies of locked jaw, fever, or long suffering and want of rest, the disease becoming fatal before that period arrive in which the tumor bursts.

Every step in the progress of this disease, even that enlargement of the inoculating arteries, which is so much wished for by the surgeon, removes the disease farther from the possibility of a cure. When at last we do operate, we

find in boring through the coagulated blood, that our finger enters among carious bones, or passes into the cavity of the knee joint, we are sensible that to persist in the operation were vain and cruel; the leg is too far gone, and must be cut off! and when we amputate, we are conscious that, in a limb so swelled and disordered, there is the utmost danger of gangrene. Every part of these descriptions argues for decision and early operation; it is a disease more inevitably fatal than cancer or gangrene; death or amputation are the sure consequences of delay; but an early operation may be successful, and early amputation is safe.

In proof of this, allow me to observe, that when the artery bursts under a strain, and the aneurism is so suddenly formed, so painful, so rapid in its increase, that the surgeon is obliged to perform his operation upon the spot, he is sure to succeed. Warner relates such a case, apparently from memory, in few words, but very decisively; the general impression of the case upon his mind seems to have been very strong. "Some years ago the operation for aneurism was performed in a similar case within a few hours of the rupture of the vessel, the tumor increasing so fast, and the pain proving so intolerable, that it was necessary to lose no time! The tibialis postica was burst in the middle of the leg; it was taken up with some difficulty, and the patient recovered."

By this early operation we perceive, that while it is the lacerated artery which produces all this confusion and disorder of the joint with caries of the bones, the operation itself is certainly successful when done before the extravasation has hurt the texture of the parts; and we have next to contrast, with the happy issue of this early operation, those cases in which the limb is cut off, after a few months delay. In a case formerly related, the disease proceeded not from a blow, a fall, or any external injury; the man was taken with a cramp in his leg; there was no pulsation, nor any other sign nor characteristic of aneurism; but when, after six months, they ventured to perform the operation, they saw distinctly the mouth, "the orifice of the ruptured artery," but it was too late to tie it! the bones were carious, and they were forced to cut off the leg*; and in the case which I

* In the month of December 1756, J. Y. aged thirty-five, received an hurt upon and about his knee, by falling to the ground from a man's back; the accident was immediately followed by a considerable degree of lameness and pain, which were increased by walking or standing; he continued in much the same state for about six weeks after the accident, at the end of this time the calf of the leg was attacked with an œdematous swelling, and in a fortnight afterwards it became so painful as to disable him from walking. The tumor continued to grow for about eight weeks, and at length extended itself so far upwards, as to affect

have printed on the margin below, you will find the same tragedy recited again, with but a small variety in the circumstances; go indeed to what collection of cases you will, you find in almost every volume, under the title of an anomalous case, a story of a neglected aneurism and amputated limb, and in every case you will see how little the surgeon had attended to the history of the disease, how little he expected blood, or a lacerated artery; you will observe what horror

the greatest part of the thigh, the whole of which was attended with excessive pain, but more particularly so about the knee. Thus much is related from the patient's own account.

On the 28th of April 1757, he was admitted into Guy's Hospital under my care; upon examination, the thigh appeared enlarged to a very great size. The tumor was uniform, and extended from the inside of the knee to within a small space of the groin; the integuments were in every part of their natural colour. Upon pressing the inside of the thigh it appeared soft, where a fluctuation was discoverable, but there was not the least appearance of pulsation on this or any other part of the limb. The tumor on its superior, posterior, and lateral parts, was of a stony hardness.

The leg (which according to the patient's account) had some time since been much swelled, did not now appear to be at all so. He was continually in great pain, and for some time past had been incapable of taking his usual rest: his appetite was bad, he was a good deal emaciated, he had a constant low fever, which began about five weeks before his admission into the hospital; he appeared pale and fallow in his complexion. From the time of his being placed under my care to the end of ten days, there was no apparent alteration in the swelling, nor in the symptoms attending it. In expectation therefore of affording him that relief which I thought could by no other means be given, I judged it advisable to open the tumor, which I did by making an incision into its most prominent part, upon which there immediately gushed out a large stream of thin florid blood, *and at this instant discovered to me the true state of that disease*, which till now could not be ascertained by any peculiar symptom distinguishable by the touch, or perceptible to the eye; seeing this, I immediately filled up the wound with lint and tow, and proceeded in as expeditious a manner as possible to apply a tight bandage upon the thigh near to the groin; and lest this might accidentally break, I applied a *second ligature* a little below the first, and proceeded to amputate the limb upon the spot: During the operation the patient fainted, but he soon came to himself again, and without any bad symptom, gradually recovered his health, strength, appetite, and rest, and is now in good health.

Upon a dissection of the thigh and leg, I discovered the following appearances: A considerable part of the fleshy portions of two of the extensor muscles of the leg, to wit, the Vastus Internus and Crureus, with the subjacent Periosteum, were destroyed. Four of those muscles whose uses are to bend the leg, and which compose the internal and external hamstrings, to wit, the Gracilis, Semitendinosus, Semimembranosus, and Biceps Tibiæ, together with that adductor and flexor muscle of the leg called Sartorius, were removed at a considerable distance from the inferior part of the thigh bone, and from the upper parts of the tibia and fibula; *by which means a large bed was formed for containing the extravasation*; which consisted in part of a fluid, and in part of a coagulated blood; by much the greatest portion of the coagulated blood was firm, and had acquired the texture and appearance of brown macerated leather. The several muscles I have mentioned had a livid and putrid appearance. The Os Femoris was carious on its anterior and posterior parts, and for the space of several inches above the condyles of that bone with the course of the linea aspera, as well as on the convex or anterior part of it, there were many exostoses.

this unexpected hæmorrhagy excites, and with what precipitation and hurry the limb is cut off*.

Although it is very certain that aneurism is often unattended with pulsation, yet it is not unlikely that sometimes those collections of blood which fill the ham, and hurt the joint, and end in caries of the bones, proceed from ruptures of the he veins; for the veins, more delicate than the arteries, are exposed to the same

The capsular ligament of the knee joint was much thickened, and contained about two ounces of a yellow and viscid synovia.

* “ *The history of a case affording a proof of the power of extravasated blood in dissolving bone.*

Vide Dr. Duncan's Commentary, Vol. VI.

“ A man of a strong and healthy habit, aged about forty-five, upon lifting a heavy weight on the 1st of October 1777, *thought he felt something give way in his right hip.* Immediately after he was very faint, but soon recovered, and for six or seven days followed his usual occupation, which was that of a brewer's fervant, with little inconvenience. During that time, he perceived *an unusual weakness in the leg and thigh,* but attended with little or no pain, *and it was treated as a sprain,* with spirituous and oily embrocations. At the end of three weeks his thigh was considerably swelled, and in ten weeks time from the accident (when I first saw him) it was very much enlarged, and the leg and foot œdematose. He had frequent returns of excruciating pain in that thigh, but it was sometimes perfectly easy, and the other leg and thigh would be inflamed and painful; sometimes he was delirious, at others had violent pain in his stomach, attended with great sickness and vomiting, which could only be relieved by volatile and cordial medicines.

“ As I was uninformed of the preceding accident, and could discover *no pulsation or fluctuation in the tumor,* the patient's history, together with the above symptoms favouring the supposition, I at first believed the disease to be entirely rheumatic. The thigh continued growing larger, till the 1st of January 1778, when it became very tense, in continual pain, and I could perceive a deep seated fluctuation. As he had no hectic fever or other symptoms that could induce me to suppose this *fluid was pus,* I began to suspect a false aneurism. The tension and pain being excessive, I recommended *emollient fomentations and cataplasms,* which, for a night, gave great relief, excepting when these pains, which by turns invaded every part of his body, were fixed in the diseased thigh. On the 12th of February, the thigh was amazingly distended in constant and excessive pains, which nothing could alleviate, and a fluctuation was felt in every part of it, from the groin to the knee. At this time it was examined by a surgeon of skill and reputation, who, considering the exquisite sufferings of the patient, and being uncertain what was the fluid contained in his thigh, thought proper to open it; and accordingly a small puncture was made through the skin, cellular membrane, and facia lata. Immediately there issued *a fountain of blood,* of the consistence of cream, and a darker colour than blood is in general when fresh and drawn from a vein. When about a quarter of blood was drawn off, the thigh was considerably diminished, and the patient easy. We stopped the orifice with a tent, and left the patient till morning.

“ Feb. 13. He had fainted several times in the night, *and this morning the thigh was almost as much distended as before the incision was made;* at the same time, the blood was constantly oozing through the orifice.

violences as the artery, since they accompany it ; and varices of the internal veins are capable of producing similar effects with proper aneurisms. The destruction of the bones arises not from the pulsation of aneurism, nor from any thing peculiar in the nature of the arterial blood, but merely from the injection of the cellular substance with the blood, together with the general pressure, and the internal ulceration, from the presence of a foreign body. Perhaps the sudden rising of a tumor

" Feb. 14. His thigh was in the same state as yesterday. He had a return of the pain in his stomach, which yielded to no medicine ; in the evening he became delirious, had convulsions, and died.

" What induced me to lay this case before you was the appearance upon dissection. That blood has the power of dissolving bone, if it comes in contact with it in the living body, though a certain fact, yet it is not universally believed. This case not only proves the truth of that idea, but it also shows, that extravasated blood, when long confined, has likewise the power of dissolving the softer parts.

" Having cut through the integuments and tendinous fascia of the thigh, I could pass my hand quite round the bone, the muscles, except their tendinous portions, being dissolved to the consistence of grumous blood, which, with a great quantity of pure blood, was contained, as it were, in a bag, formed by the integuments of the fascia lata from the groin and crista of the ilium to the joint of the knee. *The crural artery, vein, and nerve, were entirely dissolved* (and yet the limb had survived—observe how often this fact is obtruded upon us), and the iliac artery a little way was very tender. The os femoris *was deprived of its periosteum*, very rough and full of holes, some of which would admit a probe into the middle of the bone, which seemed destitute of medulla. At the same time there were several exostoses upon it, which were so slender as to be easily broke down by the finger. As I was not permitted to take away the bone, or to open the abdomen, I cannot give a more satisfactory account of the case ; but I imagine it sufficiently *proves the solvent power of the blood as exerted both on the softest and hardest parts of the system.*"

Perhaps there cannot be pointed out to your observation a more interesting case than this. How limbs may be cut off, or even life itself lost, from not understanding the nature of such a disease, is but too manifest ; there was not one circumstance of the case understood, and I hope there is not one which you can be at a loss to explain. The corrupting of the bone, and the destruction of its periosteum, are no more connected in the report than if bone and periosteum were not alive, and had no more connection naturally with each other than the glove with the hand ! The blood is considered merely as a menstruum, capable of dissolving bone, as an acid would dissolve a calcareous stone ! Nothing is attributed to the actions of the living body. An aneurism is suffered for four months to undermine the cellular substance, to choke, insulate, and destroy the muscles, to spoil the periosteum, and by that to destroy the bone. This aneurism is tapped with a lancet, as if it were an abscess ; the man faints from the inward bleeding of the artery, the sac fills up before morning to its former size, the blood oozes through this imprudent opening, and the man dies. Instead of lamenting his fate, or of understanding the case, even after dissection, it is related as an instance ! of what ? Why, of blood dissolving bone. But I think it is an instance of something much more important, and am persuaded that nothing would be more useful to the public than a set of critical and monitory observations addressed to young surgeons, and attached to the many valuable cases which are published in various collections. If God spare me health and spirits for such a task, I will perform it.

from a strain of the limb, a sense of laceration in the part, the flow increase of the tumor, and the total absence of pulsation through all its stages, may be esteemed among the signs of a ruptured vein *.

CONCLUSION.

I believe that little now remains to be done, except to draw the natural conclusions from this history of the disease.

1. We now perceive why the operation for popliteal aneurism has been so singularly unsuccessful. The straitness of the ham, the destruction of the soft parts, the pressure upon the muscles till they are hardly more alive than the coagulated blood which oppresses them, even that enlargement of the inosculating arteries which surgeons have always wished for, are unfavourable to our success; delay is fatal! when the bones have become carious, success is impossible.

2. The surgeon neglects the operation because he is uncertain of the nature of the disease. The disease proceeds not from any wound or blow, but, on the contrary, the swelling and weakness are first observed immediately after a strain of the limb. The surgeon is unwilling to believe that any such accidents can give rise to a true aneurism! That pulsation also, which he judges to be the only sure sign of aneurism, is often wanting, especially in the latter stages of the disease.

3. It has been too much a fashion among surgeons to say, at the end of any unsatisfactory consultation, "Let us try this or the other operation;" and in difficult circumstances the surgeon has often been known to make an incision into such an uncertain tumor, merely to learn what it contains. This inquisitive incision is often made without even the ceremony of a tourniquet about the limb, and when, to his utter confusion, the blood of the popliteal artery dashes out upon the operator, and the patient faints, he, in hurry and trepidation, "ties strings about the limb," and proceeds straightway to perform amputation, notwithstanding the absolute assurance of the limb being safe! For if the main artery be thus lacerated, and the limb still survive, what doubt can there be that

* In one case the disorder was fairly traced to the veins. Mr. Else in his works relates a case of this kind, in which the limb was amputated on account of the caries of the bone. Upon throwing a wax injection into the arteries, it was not extravasated in the tumor, but ran freely along the arteries to the foot. Upon examining the great vein, a rupture was found immediately above one of the valves.

But the other cases, which Mr. Else believed to have been ruptures of the veins, were quite another disease, as shall be explained presently.

the inosculating arteries are enlarged, and that the limb lives by them alone? Indeed, the reason which surgeons give for cutting off the limb, viz. that of being assured by the incision that the main artery is actually ruptured, is the very reason why they should attempt to save it.

4. To finish all, When ignorant surgeons cut off such a limb, they, after dissecting it, describe to us a burst artery, with all its consequences, as coagula of blood, matter like coffee-grounds, diseased muscles, carious bones, and a corrupted joint! nothing in their dissection is wanting to prove the disease to have been a regular, but long neglected aneurism! But they call it an anomalous case, as if they were anxious to prove that they have learnt nothing more from their dissection than from their previous inquiries into the history of the disease.

5. You will perhaps say within yourselves, "What should we do, to acquit ourselves faithfully, in so difficult a situation?"—Reflect much upon the history of your patient's disease, write it down, ponder upon it, compare it with the descriptions of authors, it is a disease in which you never need be hurried into any imprudent act. Remember how frequently arteries are burst, how slowly aneurism forms, and that when confined in a narrow cavity like the ham, or when buried under the thick muscles of the thigh, when the sac is old, and crammed with firm coagula of blood, aneurism may lose its pulsation. Do not forget this general rule of surgery, which I have ventured to lay down, "Allow no tumor to grow to a dangerous size." If a tumor have its seat about the throat, near the carotid arteries, or under the angle of the jaw; if it be in the groin, in the thigh, in the cavity of the ham; and most especially if it be at once near a great artery, and a joint such as the knee, deal with it early, and you will often in the course of your practice have the happiness of preventing those afflicting cases which defy surgery.

6. In this particular disease, first assure yourself of its nature, submit yourselves to the advice of your fellow surgeons, open the tumor early, but not like those ignorant men who are terrified at the sight of blood! When the coagula roll out, you may be assured that an artery will bleed in the end; when you have cleared out the blood and let go the tourniquet, you will see the artery; when you perceive that the main artery is wounded, the limb being still alive, you have reason to believe that the collateral arteries are enlarged and the limb safe, that you have but the common dangers of all such cases to encounter, viz. sloughing, fever, and weakness. When the artery is but a branch, as the tibial artery, you may tie it with the greater

confidence; indeed, it is only when the joint is injured, or the bones carious, that you have to cut off the limb. When you see the mouth of a bleeding artery, you should, in general, tie it with the needle, for it lies deep; when you find no artery, but observe a flow hæmorrhagy from a vein, a piece of scraped lint is sufficient; when there is an oozing of blood from a deep part of the cavity, and from uncertain vessels, you may thrust down a piece of sponge.

This neglected aneurism is the Anomalous case of Medical Collections, it is a disease for which Mr. Pott can find no other terms of description than these, "A tumor which has its seat in the middle of the calf of the leg, or rather more towards its upper part, under the gastrocnæmius and soleus muscles; it begins by a small, hard, deep-seated swelling, sometimes very painful, sometimes little so, and only hindering the patient's exercises; it does not alter the natural colour of the skin, at least till it has attained a considerable size; it enlarges gradually, does not soften as it enlarges, but continues through the greatest part of it incomprehensibly hard, and when it has got to a large size it seems to contain a fluid which may be felt towards the bottom, or resting, as it were, on the back part of the bones; if an opening be made for the discharge of this fluid, it must be made very deep, and through a *strangely distempered mass*; it either derives its origin from a bursten artery, or at least is always accompanied by it; this is a complaint affecting the leg, *removeable*, as far as my experience goes, by amputation only." A certain cure, God wot, and perfectly chirurgical.

But I must now conclude this discourse, of which the purpose has been to instruct you in the various causes of aneurism. You will no doubt have observed, that how much soever we may attribute to predisposition, aneurism arises more frequently from violence than disease; that it is not from any weakness, or from its dependent posture, that the lower extremity is peculiarly subject to aneurism. Though the muscular force of the leg is infinitely greater than that of the arm, the artery of the leg cannot have power proportioned to the muscular exertions of the limb, and the lower extremity is actually prone to aneurism from its superior strength! the artery of the thigh is disposed to this disease by being long, tortuous, and subject to the pressure of the strongest muscles in the body; the artery of the ham is endangered by the manner in which it perforates the tendon of the triceps muscle, by its loose unsupported condition where it arrives

in the ham, by its lying upon the capsule of the joint, and by the manner in which it is enclosed, between the two projecting condyles of the thigh bone.

You must have observed too, as I enumerated the causes of aneurism, that women are exempted from it, not because of the softer texture of their solids, not because their arteries are less predisposed, (for I have found examples of the crisp, thickened, and dilated artery, and of diseased and ossifying aorta, with every other mark of predisposition, more frequently by far in the bodies of women than of men), but because they are almost exempted from labour; their muscles are incapable of dangerous exertions; they live a quiet life; their business, their duties, their amusements, are all domestic. I have not seen, nor read, nor heard of one woman having an aneurism in the ham.

Men only, and those the strongest of their sex, coachmen, porters, soldiers, have aneurisms. It is from the soft luxurious habits of men in the higher ranks of life that they escape; men like women are indeed exempted from this disease. It is from the superior strength and active labours of men in the lower ranks of life that they are subject to this disease. Nor is it constant labour and the perpendicular posture that weakens the arteries, as it dilates the veins. Occasional, sudden, and bold exertions, only endanger the artery; it gives way sensibly in the very time of the strain; and the pain from that moment never ceases till the limb is swelled to bursting, the joint immovable and the bones destroyed.

It is by the surrounding cellular substance, the closeness of the surrounding parts, and the firmness of its own peculiar sheath, that an artery is so long supported and forms its sac so slowly after being thus lacerated. It is by occasional exertions of the limb, and successive hæmorrhages from the artery into its cellular sheath, that the aneurism increases from time to time; when enlarged to a certain size, aneurism becomes irresistible, and in the last weeks its progress is inconceivably rapid. When in the thigh, the disease has sometimes been spontaneously cured; but when lodged under the joint it is almost inevitably fatal.

I hope I have laid before you the materials for study, and taught you a habit of reflecting and deliberating upon the nature of this disease.

DISCOURSE VIII.

ON THE CONDITION OF AN ANEURISMAL LIMB, FROM WHICH IS DEDUCED THE SAFETY OR DANGER OF THE VARIOUS OPERATIONS FOR THE CURE OF ANEURISMS.

WE are now entering upon important speculations, and I must begin by again representing to you the condition of an aneurismal limb. For some weeks the great aneurism of the thigh increases with alarming and awful pulsation. The tumor is hard, firm, and painful, the pulse throbbing and feverish, and the aneurism begins to inflame. The lymphatics and the great veins accompany the artery, and by the size of the tumor they are so compressed, that the whole limb swells, and the particular tumor of the aneurism is almost concealed by the general turgescence of the limb. The limb now lies out a heavy unwieldy mass; the tension of it is very distressing; the cramps are frequent and terrible; the only motion in the limb is a sort of trembling and convulsive twitching; the numbness is even more distressing than the actual pain; the man lies extended on his back, with great anxieties, unable to move his limb; he has restless nights and fearful dreams, and when the disease approaches to its last stage, he is quite exhausted with fever and pain.

The last stage approaches in which the particular tumor now emerges from the general swelling of the limb; and in proportion as the proper aneurismal tumor rises, the pulsation, or rather throbbing of the whole, becomes irresistible. If the aneurism were in the breast, the very bones at such period would be burst asunder. The skin begins to change its colour, the circumference is dark and inflamed, the centre is livid, all the upper part of the member is one great throbbing tumor! while all below is cold, insensible, powerless, and swollen as with a dropsy. Now comes that eventful period, which the patient seldom survives; the signs of gangrene and death approach; the thigh becomes livid; the pulsation ceases; the gangrene seems begun. The limb itself is pa-

ralytic, cold, heavy, dead; the patient lies in that lethargic torpor which precedes death, and nature contends whether he live or die. But gradually the patient recovers from this deadly slumbering; the low delirium goes off; the fever subsides; the limb recovers its natural heat; the activity of all its vessels seems to be renewed; but the pulsation in the tumor and in the course of the tumor is gone! The general swelling falls by slow degrees; the crammed and solid hardness of the limb gradually softens; yet half a year generally elapses before it is reduced to any seemly shape, or to any thing near its natural size. When the aneurism first loses its throbbing, it is a sign that the great artery is oppressed, soon to be obliterated, which obliteration is accompanied sometimes with death of the member, sometimes, though rarely, with a renewal of life. When the limb recovers its natural heat, without any renewed pulsation in the aneurism, it is a sign that the main artery is obliterated, the collaterals enlarged, and the limb safe; and as the limb gradually softens, we can, in the progress of the cure, force the points of our fingers down into the bed of the artery, and feel the remains of the aneurism and of the obstructed vessels like a firm and knotty cord.

This description of the disease shows the nature of those sufferings of which the patient often dies without bursting of the tumor, or loss of blood. Sometimes the tension of the limb is such that the cramps rise to the violence of convulsions, the patient expiring with a general convulsion of the whole body, along with slighter tremblings of the affected limb. Often the continued fever, the pain, the want of natural rest, the horrid dreams, and the delirium produced by this scene of misery, proves fatal. Sometimes though the whole limb is not tainted with gangrene, the aneurism itself becomes gangrenous, and the patient falls into the low delirium and dies. Usually the lividity of the aneurism increases, the skin becomes thin, inflamed, dry, and chapped; it cracks; blood serum oozes out; sometimes there is a detached eschar supported by a clot below, rising and falling with each motion of the pulse; at last it bursts, and at one gush he loses two or three pounds of blood; he lies in a low and muttering delirium during the night; recovers somewhat in the morning, but is sick and languid, and with the next slight gush of blood expires.

But sometimes the pulsation having ceased, the limb becomes cold only for a time, the heat returns and the patient is saved. There is a certain critical point to which, when the aneurism arrives, the struggle betwixt the pulsation and the

resistance must end suddenly. If the pulsation is to prevail, the parts become thin, the tumor bursts, and the patient expires. If, on the other hand, the resistance be such as to oppress the artery, then the pulsation does not all at once cease, but the collateral arteries enlarge, and begin to carry off the blood from the aneurism at the very moment it threatens to burst. By this change of circulation, the pulsation of the artery is weakened, so that the swelling, weight, and resistance of the surrounding parts, and of the coagula formed within the aneurism, are able to resist the stroke of the artery; its pulsation flags, and the collateral arteries enlarge; its pulsation at last ceases, and there is to be observed betwixt the loss of one circulation and the establishment of another, an interval of coldness and deadness in the limb. The circulation is thus for some time upon the turn, and when this critical period arrives, the limb is prepared for the happiest changes, and no sooner is the circulation in the great artery stopped, than that of the collateral arteries is substituted in its place.

But if this natural aneurism of the artery bursts, the blood can no longer go along in the same course; the artery being burst, its blood is poured abroad into the cellular substance; the vessel itself is obstructed by the coagula, and oppressed by the continually increasing tumor; if the skin also bursts at the same time, the patient expires. But where the skin resists the aneurism a few days longer, the circulation in the main artery ceases, the artery itself is flattened and compressed, the collateral arteries enlarge, and the limb recovers from the interval of cold and numbness; the skin and cellular substance give way a few days after, but there is no loss of blood, because the channel of the main artery is already dry; and though the patient may die, exhausted, yet the limb is safe. If it unfortunately happen that in the moment of this turn in the circulation of the limb, the surgeon takes the alarm, calls a consultation and cuts off the limb! he finds that three or four arteries bleed from the interstice of each muscle, ten or twelve arteries bleed from the general surface of the stump; he has the mortification to perceive that he has cut off the limb in the very moment when nature was providing for its safety! his patient dies on the third or fourth day, from causes which I shall presently explain.

This enlargement of all the smaller arteries implies a condition of an aneurismal limb, which, though hitherto unnoticed, is too full of important conclusions to be but slightly explained; and the condition of the aneurismal limb is still the same, whether we perform the cure by tying the artery, or attempt it by com-

pression, or whether we neglect the aneurism till it obstructs the artery and obliterates it by its pressure, or bursts inwardly among the cellular substance. And I will undertake to prove to you, that it cannot be a matter of indifference to operate upon a limb in this condition.

When the celebrated Guattani found that the operation for popliteal aneurism was hardly practicable, and amputation itself no sure refuge, he began to turn his thoughts towards the medical cure of aneurism! he hoped to invent some way of resolving the aneurism by compressing the tumor itself, and diluting the blood contained in it. He at last succeeded in curing aneurism by long confinement, with compression and firm bandaging; and he believed that he had repressed the aneurism, and actually saved the channel of the blood, by preserving for it a free course through the main artery of the limb. I know it was universally the opinion of those great masters that they saved the channel of the artery, but I resort to their works, not for their opinions, but for their facts; and to be plain with you, the more I study their facts, the more am I hardened in this infidelity with regard to their opinions.

Guattani was fully persuaded that he resolved the blood, squeezed and melted down the coagula, returned the fluid parts into the circulating system, cleared the artery, repressed the tumor, and preserved the circulation through the main trunk of the limb. I need hardly quote passages; I do not need to search curiously for proofs of this doctrine! it was his only one, and every expression in his book involves some proof of it. "When I reflected particularly," says Guattani, "on those aneurisms which occur in the limbs, I began to imagine, that by confinement to bed, by reducing the habit of the whole body, by compressing the artery so as to prevent the full flow of blood towards the aneurism, and by a gradual, steady, and slowly increased pressure upon the aneurism itself, I should be able, not only to prevent the further growth of the disease, but to accomplish in time a complete resolution of the clotted blood into serum, thin enough to return into the course of the circulation, and thus to disperse the tumor altogether*."

* Quum vero ea potissimum aneurysmata inspicerem, quæ in articulis oboriuntur, in suspicionem adductus sum, quiete cubilis, ac extenuatione totius corporis, nec non simul cohibendo sanguinis cursum in arteria ad affectum locum tendente, ac denique linteorum beneficio ipsummet gradatim comprimendo tumorem aneurysmaticum, fieri posse, ut non solum illius augmentum prohiberetur, sed tractu temporis paulatim in serum sua sponte converso, et ad permeandum idoneo reddito sanguineo grumo, ipsius quoque tumoris omnimoda resolutio tandem aliquando contingeret.

Guattani succeeded often in curing aneurisms of the ham by compression, and when he failed, his disappointments are acknowledged so freely, as to prove him to be a truly great man. His successes were unequivocal, but the process by which he accomplished the cure is far different from this resolution of the blood which he imagined. He performed the cure by spare diet, rest, compresses, and a well rolled bandage continued for months; and I suppose these to have been the effects of his method. First of all, this kind of pressure resists the further extension of the tumor, and the bandage, though severe at first, never fails, in a little while, by opposing the extension, to relieve the pain. In the next place, the artery being resisted in this outward direction, the limb is brought suddenly, but simply, into that state which is so dangerous in the last stage of aneurism, for by this pressure the artery is opposed, the circulation is less free, the blood is turned towards the collateral arteries, the limb remains for a few days cold and numbed, and is gradually prepared for the final cure. It is essential to your understanding this cure by compression, that you observe the following fact: Aneurism is not what it has been represented, a fair round bag containing fluid blood, communicating freely with the artery; no aneurism is truly reducible by pressure; aneurism is hard and firm, even of a stony hardness; were it otherwise, how could it resist compression for months? The aneurism, whether true or false, is filled with solid knotty coagula, and resists perfectly. The very tumor itself serves as a compress for the artery, the pressing down such tumor compresses the artery betwixt it and the bone, and this is the true reason why a simple compress and a general roller cures aneurism, without those cunning screws and cushions which the older surgeons invented so ingeniously for making a partial compression. The aneurismal tumor being itself hard and firm, conveys the compression to the main trunk of the artery, which is compressed betwixt it and the bone, while the collaterals lodged among the sound and fleshy parts escape the pressure.

Were the opinions of those pathologists correct, that the blood were resolved, the aneurism repressed, and the canal of the artery preserved, the tumor should yield at first, then become flaccid, then its blood should be altogether discharged into the artery, and the artery should be apt, on removing the bandage, to inject the empty bag and fill it again; in short, the sac of the aneurism should be repressed as a prelude to the cure of the disease. Again, suppose (by some process of the economy, which I cannot foresee, and which surely never did happen), that this were really the succession of the phenomena in this cure, the artery after such a

cure should carry its blood freely, the pulse should be as strong as ever, and whatever remained of the tumor, though it were but a thickening of the parts, should receive the stroke of the artery, and this residuum or remains of the tumor continuing to pulsate thus, the operator never could be assured of his cure, and would never lay aside his compress.

But in truth the last stage of the process is this: The artery being for some time opposed by the gradually increasing tension of the parts, the blood is thrown upon the collateral branches; the blood passing along the collateral branches allows the compression to be increased without that intolerable sense of numbness and pain which the compressions of the first week causes. At last the compression is supported boldly, firmly, unremittingly. If the operator stop short of this, the disease returns; but if he entirely compresses the artery, the blood forsakes it, the pulsation stops, the tumor remains solid and firm, and does not enlarge because the blood no longer flows into it, nor does it even beat again, because the artery which lies under it is obliterated by the pressure. The artery is obliterated for months before the pulsation ceases, but the tumor never entirely disappears, there always remains in the ham, a knot so firm as to resemble an exostosis of the bone, and so attached to the joint as to cause a degree of stiffness. It is only from ignorance of this process that the operator does not leave off his compression, when the tumor becomes stationary, when the pulsation ceases, when, in short, the artery is obliterated; it is often continued, on the contrary, till it produces rigidity of the joint. Thus, we perceive, that Guattani, when he cured by compression, had no reason to continue his bandages for years, nor to fear a return of the disease. He performed, in fact, a radical operation, he obliterated the artery as fairly as if he had tied it with the four tapes which have been so often used in this piece of surgery. But I will relate the manner in which he performed his cures, and you shall judge yourselves whether the aneurism was repressed merely, or whether the artery was absolutely destroyed.

“ A porter, about forty years of age, of an athletic and sanguine habit, had an aneurism of the ham as large as the biggest goose egg, hard, elastic, pulsating very strongly, with fever and a general swelling of the limb. Guattani had resolved to perform the operation for popliteal aneurism, but was willing to defer it till the swelling should subside. He laid the patient in bed, bled him and kept him to a very spare diet, and this was, providentially, so singularly useful, that not only the increase of the disease was arrested, but in the course of little more

than a month, the pain entirely ceased, the violence of the pulsation was somewhat abated, and the general swelling was very greatly lessened."

" Having to accompany the Pope during his retirement in the autumnal season, Guattani thought it advisable to delay the operation for three months; but finding upon his return the tumor nothing larger, and the general swelling of the limb quite gone, he resolved to try the compress and bandage. He formed two long compresses, crossed them over the centre of the tumor in the ham, and made their ends encircle the knee above and below. He laid also a compress up the thigh, along the course of the femoral artery, and with a very long roller, three inches broad, he encircled, first the knee, and then the thigh, finishing with one turn round the pelvis to keep it firm; from time to time he poured spirits of wine on the bandages, which, when well applied, kept firm for eighteen or twenty days. Every time they were renewed he drew them a little firmer."

" Though the tumor long preserved its form, hardness, and pulsation, yet in the course of exactly three months the patient left the hospital perfectly cured; nor was any thing of this great tumor left, except a sort of callosity or hardness of the size of a bean. He returned to his business of a common porter, paid no attention to his diet, strained frequently under the heaviest loads, yet never had the slightest return, nor felt any greater inconveniency, than a trifling swelling of the foot and ankle."

" A year after, this man lay ill of an epidemic fever in the hospital, without the ham being in the least distended by the increased force of the circulation; and since (says Guattani) neither walking, nor the exercise of his laborious profession, nor this febrile increase of circulation, had in any degree disturbed the ham, I am safe to conclude, that a free circulation of blood, even in the vessels of the ham itself, was effectually restored *." Thus does Guattani affirm, in direct terms, that the canal of the popliteal artery is preserved. But we shall judge, perhaps, more decisively of his doctrine, after reading another case, where, though the process of the cure is the same, the relation of the phenomena which attends it are somewhat varied.

" The second cure was performed upon a man of forty-five years of age, a

* " Ad hæc, anno 1766, iis, quæ tunc temporis grassabantur, febribus correptus quum esset, quum tertiani duplici laboraret, ad Nosocomium reversus est, ibidemque amissam valetudinem perfecte recuperavit, absque eo quod affectus poples, ex aucto per febrim sanguinis motu, perturbationem ullam acceperit. Quum igitur nec ambulatio, nec labor, nec auctus a febre humorum circuitus poplitem quadantenus exasperaverint, *rationi consentaneum videtur omnimodum vel in articulo sese per vasa movendi redditam humoribus libertatem fuisse.*"

grave-digger. His aneurism was large, with pain, fever, a throbbing pulse, and great swelling of the limb, but not particularly hard; you rather seemed to feel in it a sort of fluctuation. But the cause was well marked; for "in the last week of July, he had hurt his limb in a very violent effort; it was while he strained very hard in lifting the confession-desk from one part of the church to another, that he felt something give way in his ham, with a sudden pain, but yet bearable, so that he was able for some time to continue his labours. He was ignorant of the nature of his disease, and had used only the more harmless applications, till the time of his being laid in the Hospital of St. Peter's, under Guattani's care *.

"This man was brought to the hospital in the first week of August. For the first eight days he was bled, dieted, confined to bed, and reduced so that the stricture of the bandage might be safe and tolerable. Then the compression was begun, carried on step by step, and occasionally renewed; but on the first week of November Guattani found that the pulsation of the tumor had entirely vanished, and the tumor remained moveable †" "Yet I failed not (says he) to renew the compression, and with such happy success, that by the middle of January my patient left the hospital perfectly cured, excepting a halt in his gait, and that not remarkable." "Two months after I sent for him to examine the parts, when I found in the ham nothing but a small hardness, about the size and shape of a chestnut, resembling an exostosis ‡."

There cannot be imagined a more correct history of an artery obliterated by

* "Quum ex eo quaereretur, a quam causa ejusmodi tumor obortus esset, respondit *ex valido nisu* quem in penultima transactæ quadragesimæ hebdomada articulus fecerat. Dum enim cathedram sacræ confessioni dicatam ab uno ecclesiæ loco in alium transferret, *se quamdam in poplite persensisse veluti divulsionem*, ex qua dolor emerferat, sed ita tolerabilis, *ut consuetos labores ad pentecosten usque continuaverit*. Ab hoc autem tempore ad illud, quo ad nosocomium delatus est, quod tumoris naturam ignorabat, etsi augmentum illius videret, nullis, nisi ad leniendum dumtaxat dolorem, remediis quibusdam vulgaribus usus erat."

† "Primis igitur octo diebus sat mihi fuit, ægrotanti in lecto quiescenti rigidam imperare diætam, eique binas sanguinis missiones efficere. Quo factum est, ut omnia lenirentur symptomata, tumorque mollitiem adhuc majorem nancisceretur. Tunc ad aliquot alios dies linteis posca madentibus usus sum, dein gradum feci ad compressivam, attamen mediocrem vincturam, quam pro necessitate iteravi, primisque Novembris diebus, quum illam iterum instituerem, *deprehendi, pulsationem arteriæ prorsus evanuisse, ac tumorem omnino fluitantem fuisse redditum*: sed nihilominus affectam partem fascia ligare rursus non destiti eadem methodo, quam in prægressa observatione adhibueram. Atque ita feliciter cessit, ut æger V. kalendas Januarias in statum valetudinis pristinum restitutus e nosocomio discesserit, nullum aliud incommodum secum ferens, præter aliquam, eamque parvam claudicationem."

‡ "A precedente sensibilibiter differet, non solum quod ab initio mollitiem aliqualem ostenderet, longeque ante sanationem omnino molle redditum esset, sed etiam quod ante dies quinquaginta, integræ sana-

compression. The patient was bled, and purged, and confined to bed, which relaxed the parts, and the tumor was so compressed, that in the course of one month the pulsation disappeared! The pulsation had disappeared, though the tumor remained, which shows that there was not pulsation enough in the artery even to raise the tumor. The tumor was now moveable in the ham, yet nothing is said of its connection with the artery; there was not even the slightest pulsation in the artery, to remind Guattani of that connection betwixt the now pervious artery and remaining tumor, which otherwise he would have described with so much care. He next performed a work of supererogation, for the artery was obliterated, the pulsation gone, the rest should have been left to nature; but he applied his compress and bandage again, and in the two succeeding months did no more than stiffen the ham.

But desirous, after two months, of knowing the state of the parts, he sent for his patient again, examined the ham; and now he found that he had compressed the aneurism into a hard and bony knot, and had so fixed the tumor, formerly moveable (*fluitantem*), betwixt the condyles of the thigh bone, that it resembled an *exostosis*. Here again a new state of the tumor is described, at the distance of three months from the time of the cure, and yet not one word of the artery nor its pulsation, no curious distinctions betwixt the pulsation of the artery now in its natural condition, and the diseased pulsation which it had during its aneurismal state. Here is described a tumor, firm in its own consistence, and fixed to the joint and bones like an *exostosis*. How could there remain any canal, artery, or vein in the ham under this tumor? We may be assured, that in this method of cure by compression, just as in the radical cure by ligature, there is an entire change in the circulation of the limb!

Let us next observe, whether we have not the same marks of obliteration of the artery, even in those cases of spontaneous cure, where the surgeon thinks that the canal of the great artery is still pervious. Mr. Blagden, surgeon at Petworth, was consulted by * a man of about fifty years of age, tall and muscular, who had his humeral artery wounded in opening the basilic vein. The blood flowed in great quantity, and, per saltum, was stopped by strong compression.

tione prævios, pulsatio pariter in totum evanuisse, quum in priori aneurismate usque ad omnimodam sanationem cum durities, tum quoque pulsatio jugiter perdurassent. Duobus vero post ægrotantis e nosocomio discessum elapsis mensibus, quum illum accersivissem, ut eundem rursus inspicerem, nil aliud in ejus poplite deprehendi, nisi parvam duritiem, quæ castaneæ figuram, ac magnitudinem habens, exostosim mentiebatur, atque ipse Damianus per paululum tunc temporis claudicabat."

* Medical Tracts, Vol. II.

First an ecchymosis extended itself generally from the shoulder to the wrist; then the aneurismal tumor formed, and in six months it had increased to the size of a cricket ball. The arm was oppressed, cold, shrunk, and, as the patient expressed it, painfully lifeless; he was advised to have the operation performed, but he first thought of consulting Mr. Blagden.

Mr. Blagden found the aneurism of this great size, hard, with a strong pulsation in it, but the fore arm below was cold and pulseless. Now the patient had assured Mr. Blagden that the tumor had been larger, that it was subsiding, that the pulse in it was somewhat abated; and Mr. Blagden did not scruple to advise, that he should wait the issue of these changes, rub the arm with the flesh-brush, and refrain from exertions.

In a few weeks the arm grew a little warmer; in about three months he began to be sensible of a tremulous pulse at the wrist; the tumor gradually diminished, and the strength of the pulse at the wrist increased; in eight or ten months the tumor in the bend of the arm was reduced to the size of a hazel nut, while the pulse at the wrist was quite restored, and the arm as full and fleshy, as capable of as powerful exertions, as the sound one, but he was desired to avoid such exertions.

The author concludes with this sentence: "It is too evident to admit of any doubt, that the circulation is carried on in its usual course through the artery, and not through the lateral anastomosing branches of it*."

I am well assured, that in this case the blood passed only through the anastomosing branches; the profunda and ramus anastomoticus were enlarged, the trunk obliterated, the circulation along the fore part of the arm gradually subsided in proportion as the vessels upon the back part enlarged; and I found my opinion upon certain expressions of the author, very clear I think and intelligible, and which I shall presently quote.

When an aneurism grows to so uncommon a size as this, it is implied that the artery is largely wounded, but still, being supported by clots and by the resistance of surrounding parts, it transmits a tolerable proportion of blood. When the aneurism arrives at the size of a cricket ball, the disease must take a turn; the forces of the pulsating artery and of the tense aneurism lying over it are nearly balanced, and either the force of the artery must overcome the resistance of the surrounding parts, and the aneurism burst, or the resistance of the parts must suppress the action of the artery, and then the anastomulations must enlarge. If the artery be largely wounded, it will throw out much blood, it will form

* Vol. II. page 50.

a very large tumor, but it will not have force to push that tumor beyond a certain extent. The artery thus wounded being little able to transmit blood for the nourishment of the arm, the inosculating arteries will enlarge, the impetus of the main artery passing under the tumor will be gradually lessened, while the resistance of the tumor will be still the same, the clots will become firmer by the absorption of the thinner parts, and the cellular substance will become thicker by successive inflammations. The fascia in the bend of the arm, naturally strong, will now be greatly thickened; the resistance of the tumor and the action of the artery being thus balanced, the one will soon overcome the other, the pulsation in the aneurism will flag, the course of the blood through it will relent, the arm below will be for a time cold and powerless, and as the blood does not pour, as before, into the aneurismal sac, the size of the aneurism will begin to diminish almost as soon as the pulsation of it subsides; then the collateral arteries will enlarge, and the spontaneous cure thus begun will end in the total obliteration of the main artery; the recovery of heat in the lower part of the arm, and the pulse (fluttering and hardly sensible at first) will be slowly re-established.

Those various steps of the process are perfectly marked in Mr. Blagden's relation of the case. First, When he saw the aneurism, it was large as a cricket ball, the arm below was oppressed, it was "painfully lifeless," there was no pulse in the wrist, and the tumor was beginning to decrease in size! The forces at that period were divided, and the inosculations were beginning to enlarge. Secondly, Within a few weeks the arm grew warmer, he could perceive a tremulous kind of motion at the wrist, the tumor very gradually diminished, the pulse in the tumor grew weaker, and the motion at the wrist strengthened in proportion as that at the bend of the arm subsided! Is this the way in which the pulse of the wrist should strengthen, if the blood by which that part of the artery was filled, was conveyed by the main artery through the bend of the arm under the tumor? Lastly, "The tumor grew hard as it diminished in size; when reduced to the size of an apple, it was perfectly incompressible; it was thought to have become perfectly stationary, but in the course of eight months, it was reduced to the size of a hazle nut, and lost much of its hardness." This is just the description of an obliterated artery. In this passage not one word is said of pulsation in this remaining tumor, nor of the free action of the artery lying under it in the bend of the arm! In a tall and muscular man, such as this was, I think I could undertake, after this spontaneous cure, to point out the ramus anastomoticus in its enlarged state turning under the inner condyle of the os humeri.

Let us now attend to the effects of our ligature, not upon the artery which it intercepts and cuts across, but upon the tide of blood which it diverts to the other arteries of the limb. When we operate with ligature on the artery of the thigh, we can mark the very instant in which the artery is obstructed; we perceive, after a momentary coldness and deadness of the limb, a renewed action of its vessels and increased heat. We find the limb cold when its blood is for a moment obstructed; we find its heat rising far above the natural pitch, while as yet there is no pulse in the great arteries of the lower part of the limb, for at this time all the smaller arteries of the limb are enlarged and acting very powerfully. The smaller arteries perform for a certain term the office of transmitting blood; but when one artery takes the lead, and acts with such power as to become the direct trunk for all the arteries of the lower part of the limb, then the general vascular action of the limb subsides, the blood is drawn into one or two channels, the vessels in general resume a natural and quiet action, and the heat, which had risen 6 or 8 degrees above the natural temperature, falls to 96. If this be the true account of what is passing in an aneurismal limb, we should be able to demonstrate the fact.

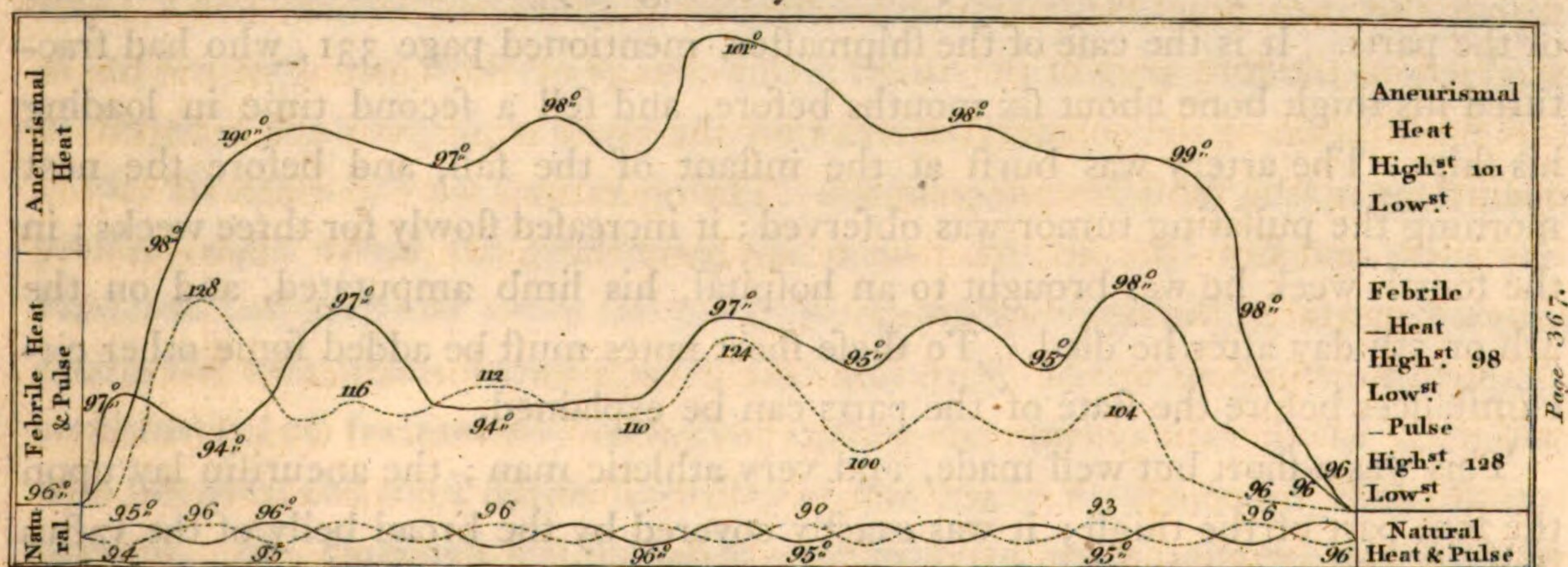
I take this rising of the animal heat in a limb to be the surest test of the action of its arteries; and the cases by which I would prove this important fact are of the most unexceptionable nature, they are three in number, they are cases in which the aneurismal sac was not touched by the surgeon, in which the artery was tied on the fore part of the thigh; this change of the current of the blood, this substitution of the collateral arteries for the great trunk, was effected in those operations in the most simple manner. The operations were performed by Mr. Forrester, and from the first moment of applying the ligature, Mr. Babington of Guy's * measured the heat twice a-day.

I shall now present to you (with some slight variation) the tables of heat; you will judge whether the phenomena which they present correspond with the changes which I have supposed. You will remark, first, That during the whole of the feverish period, while the limb was inflamed, the pulse rose to 100, and often to 128. Secondly, That the general temperature of the body, as measured *by applying the thermometer to the arm*, rose with the pulse, but the increase is slight, the variation extending only from 68 to 72. Thirdly, You will remark, as you run your eye along this table, that the sound leg is little affected by the occa-

* Dr. Babington, lecturer on chemistry at Guy's Hospital, is well known for his acute abilities and amiable manners. I should think myself ungrateful, were I to neglect any opportunity of acknowledging the pleasure and instruction I have had from his conversation.

fional rifings of the pulse. By applying the thermometer *to the found thigh*, the heat was found usually to be at 96 or under, seldom falling below 89, or rising higher than 98.

But you will, last of all, observe, that the aneurismal limb which has suffered the operation, and whose main artery has been tied, is not deprived of circulation, as has been represented, nor cold, nor apt to fall into direct gangrene; its circulation is intense! if disposed to gangrene, it must be to that gangrene which arises from excessive action! The heat of the limb *whose artery has been tied rises* on the day of the operation to 98; its temperature never, during the sixteen days of fever, falls below 97. This unnatural heat often rises to 101. This limb always preserves a degree of heat exceeding that of the found limb by several degrees. One day we find it fall so low as to 94; but probably that arose from the cold stage of some febrile attack, for the heat of the body in general fell on that day to 68; and on the following day the pulse rose to 124, the natural heat of the arm to 72, and the heat of the diseased limb to 101; and on the same day the ligature came away. On the 16th day from the operation the natural pulse is restored; the fever goes off; the pulse is 95; the heat of the found limb is natural, it is 96; the heat of the aneurismal limb descends to meet it, and is also 96; the heat of the aneurismal limb then becomes natural, and the aneurismal state ends on the 16th or 20th day *.



In this plan † are represented, by waving lines, 1st, The natural movement of this man's pulse about 95, and the natural heat of his thigh, as marked by the

* In the second operation performed by Mr. J. Hunter, it would appear, that after having become 5 degrees hotter than the found limb, the aneurismal limb had recovered its natural temperature by the 4th day. *Vide Medical and Surgical Transactions*, p. 159.

† My friend, Mr. Kite of Gravesend, could have contrived to represent this very neatly. Perhaps nothing can be more ingenious, curious, or useful, than his Meteorological Tables.

thermometer, varying very little from 96. 2dly, There is represented, by a second line of figures, the rising of the pulse immediately after the operation; and there accompanies this elevation of the pulse a waved line, representing the febrile heat of the sound thigh, varying according to the movements of the pulse, and rising sometimes to 98. It will be observed, that the heat of this the sound limb is often below 96, that limb being generally cold through the whole progress of the disease. 3dly, The highest waving line, marked with the degrees of heat, shows how much more the limb which had suffered the operation was affected by this febrile state; and the waved line, and the degrees marked upon it, indicate the aneurismal heat of the limb rising sometimes very high, to 101, and always keeping above that of the sound limb.

But if this increase of heat proceed really from the change in the state of the vessels, should we not find proofs of it in the increased diameter of its arteries? and so we do. The smallest arteries are enlarged to an important size; the number of apparent arteries, such, I mean, as the surgeon has to stop with the ligature in his operations, is astonishingly increased in an aneurismal limb; and I enter upon this part of the proof with pleasure, because the most important conclusions arise from the consideration of the fact.

I promised to return to that case of aneurism in which my friend Mr. Harkness was forced to amputate the limb, and will now give you a full account of the state of the parts. It is the case of the shipmaster, mentioned page 331, who had fractured his thigh bone about six months before, and fell a second time in loading his ship. The artery was burst at the instant of the fall, and before the next morning the pulsating tumor was observed; it increased slowly for three weeks; in the fourth week he was brought to an hospital, his limb amputated, and on the 4th or 5th day after he died. To these short notes must be added some other circumstances before the state of the parts can be explained.

This was a short but well made, and very athletic man; the aneurism lay upon the fore part of the thigh; it was exactly covered by the broad belly of the vastus internus muscle, but it did not at all oppress the ham, otherwise than by pressing the tendons of the inner ham-strings backwards very strongly, for the aneurism lay entirely above the passage through the triceps. The aneurism seemed exceedingly large, because it heaved up the muscles, and was also covered with integuments greatly thickened by inflammation, for the limb was naturally very gross, the man was fat, the muscles very plump, the skin well provided with cellular substance, and not yet thinned by extension, but only slightly inflamed. From these causes

the tumor seemed very large and diffused, almost covering the knee joint, whereas, upon dissection, the real aneurism was found to be fairly circumscribed, facculated and small, holding but about a pound and a half of blood. Its throbbing was of a very alarming kind, not because the pulsation was strong and distinct, but deep, heavy, and what the French term *sourd*. The pulse moved rather the whole substance of a very fleshy thigh, than any particular tumor.

The tumor increased very slowly, considering the size of this artery, for the great femoral artery was cut almost entirely across. There was no possibility of blood passing to the limb through the main artery, the inosculating arteries were of course in full play; they sustained the limb for three weeks, and their action of course drew off the tide of blood from the main artery; its aneurism was growing very slowly, and its pulsation was rather less terrible than it had been.

The swelling was most prominent about two hands-breadth above the knee, its centre was over the place where the artery passes through the triceps muscle, it was there that the patient felt the first pulsation, it was to that part that he pointed as the seat of his chief pain, and it was just under that point that we found the artery wounded or lacerated by the broken bones.

This was not indeed one of these cases where one might say the patient had not many days to live, but yet it was a case inevitably fatal! operation was unavoidable! it was for the purpose of having the operation performed that he was laid in the hospital, and he was a manly hardy fellow, willing to submit to any kind of surgery, especially if it could but preserve his limb.

Mr. Harkness lost no time in calling a consultation. Out of twelve gentlemen present, eight voted for preserving the limb. But on the morrow when Mr. Harkness had prepared every thing for the operation of aneurism, the gentlemen taking the case again under review, and especially reflecting on the dangerous combination of fracture and aneurism, and on the difficulty of saving a person who has even the most simple aneurism of the thigh, they reversed their former opinion. Mr. Harkness was forced to amputate the limb, and on the fifth or sixth day the man died of gangrene.

The dissection of this limb explains particularly well, the condition of a deep seated aneurism occasioned by a fractured bone, it explains also matters of much higher importance, and especially it demonstrates the danger of amputation, and the ease with which the artery, in such circumstances, may be found and tied.

Of this dissection, there are three slight etchings, and a more finished drawing.

Figure 1st shows the outside appearance of the limb; the skin is dissected away; the fascia also which formed the external covering of the tumor, which was exceedingly thick and firm, and descended very strong over the gastrocnæmii muscles, is dissected off. Under the fascia lie the muscles, and now it will be understood how deep such an aneurism lies, how entirely it is covered by the largest muscles of the limb; let it be noticed, that the aneurismal sac lies under the thickened skin, the oedematous cellular substance, and these thick muscles of the thigh, then it will be easily understood why in consultation the aneurism, though in itself small, round, and regularly circumscribed, seems so large and so diffused. Of these muscles (a a), marks the Vastus Internus, and the aneurism lies right under it, the fibres of the muscles being extended over the tumor almost to parting; the muscle is connected with the proper aneurismal tumor only by cellular substance; and at (b), the muscle is cut, its cut edges left abrupt, and the aneurismal sac (b) is seen protruding. The sartorius (c), the gracilis (d), the semitendinosus (e), the semimembranosus (f), those muscles whose tendons constitute the inner ham-string, lie along the inside of the tumor. The flesh of the vastus externus (g) is seen on the other side of the thigh where it was cut in amputation, and the biceps cruris where its second head comes off from the linea aspera at the back part of the thigh bone is also seen at (h), as cut across by the amputation knife. (i) is the belly of the gastrocnæmii, and (k) is the skin turned down.

Figure 2d shows those muscles laid aside in order to show the proper aneurism, where (a) marks the broken extremity of the thigh bone, (b) the semimembranosus, (c) the tendon of the semitendinosus which forms the ham-string of the inner side, (d) the biceps which goes to form the ham-string of the outer side, (e) the heads of the gastrocnæmii muscles lying betwixt the two ham-strings. But the parts which particularly relate to the aneurism are these, the vastus internus (f) which was expanded over the aneurismal sac, is here cut and laid aside to show the sac. (g) is the triceps magnus, where it is just going to be fixed to the linea aspera of the thigh bone, and (h) is its tendon ending in the condyle. (i) is the aneurismal bag now plainly seen to be independent of those external coverings of the tumor. It may now be perceived that the aneurismal sac belongs chiefly to the periosteum, and to the cellular substance which lies round the bone and under the muscles. (k) marks the femoral artery and vein, about two inches above the place where they pass through the triceps muscle, betwixt it and the thigh bone, and (l) marks the same artery and vein,

43

Fig. 3.

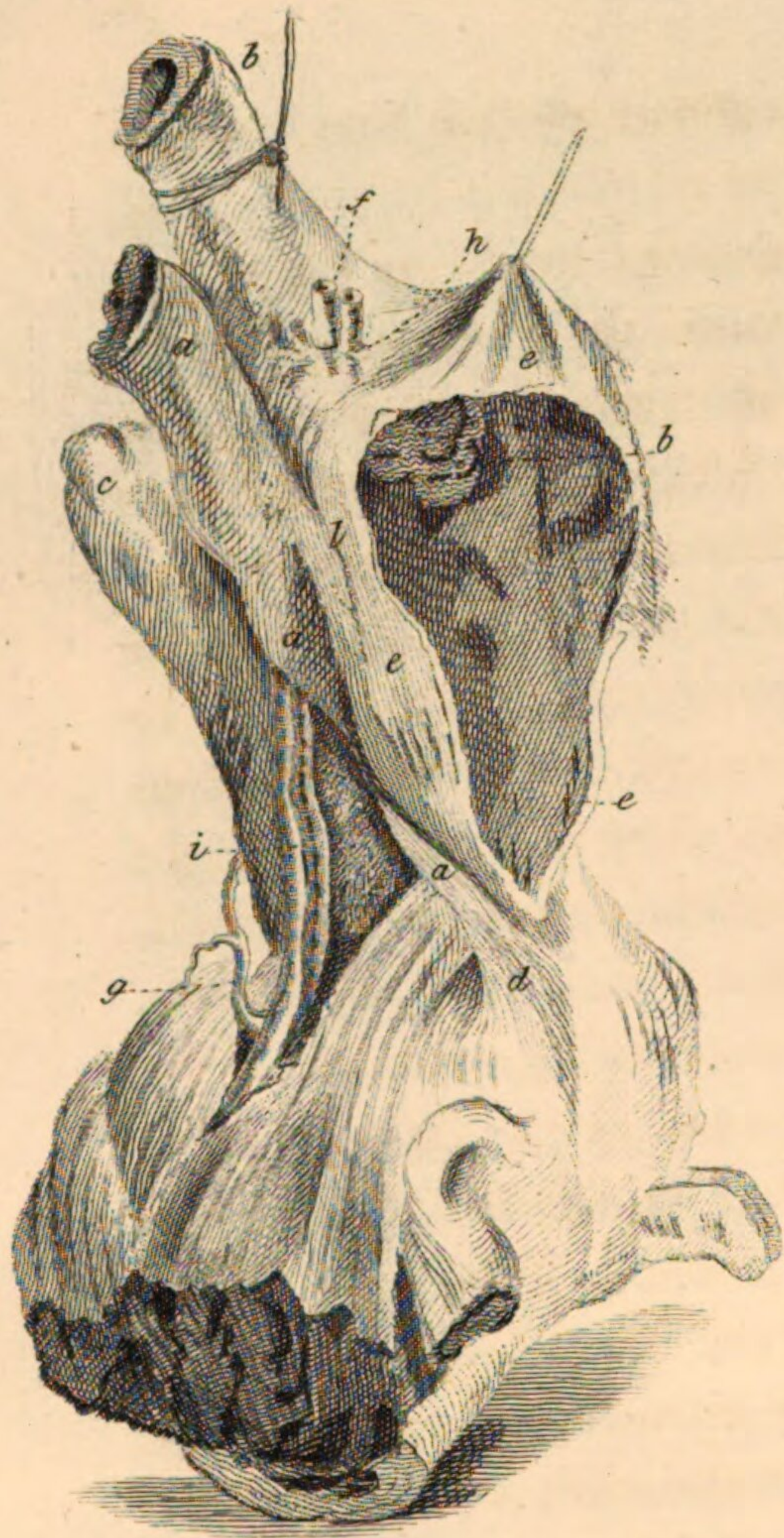


Fig. 2.

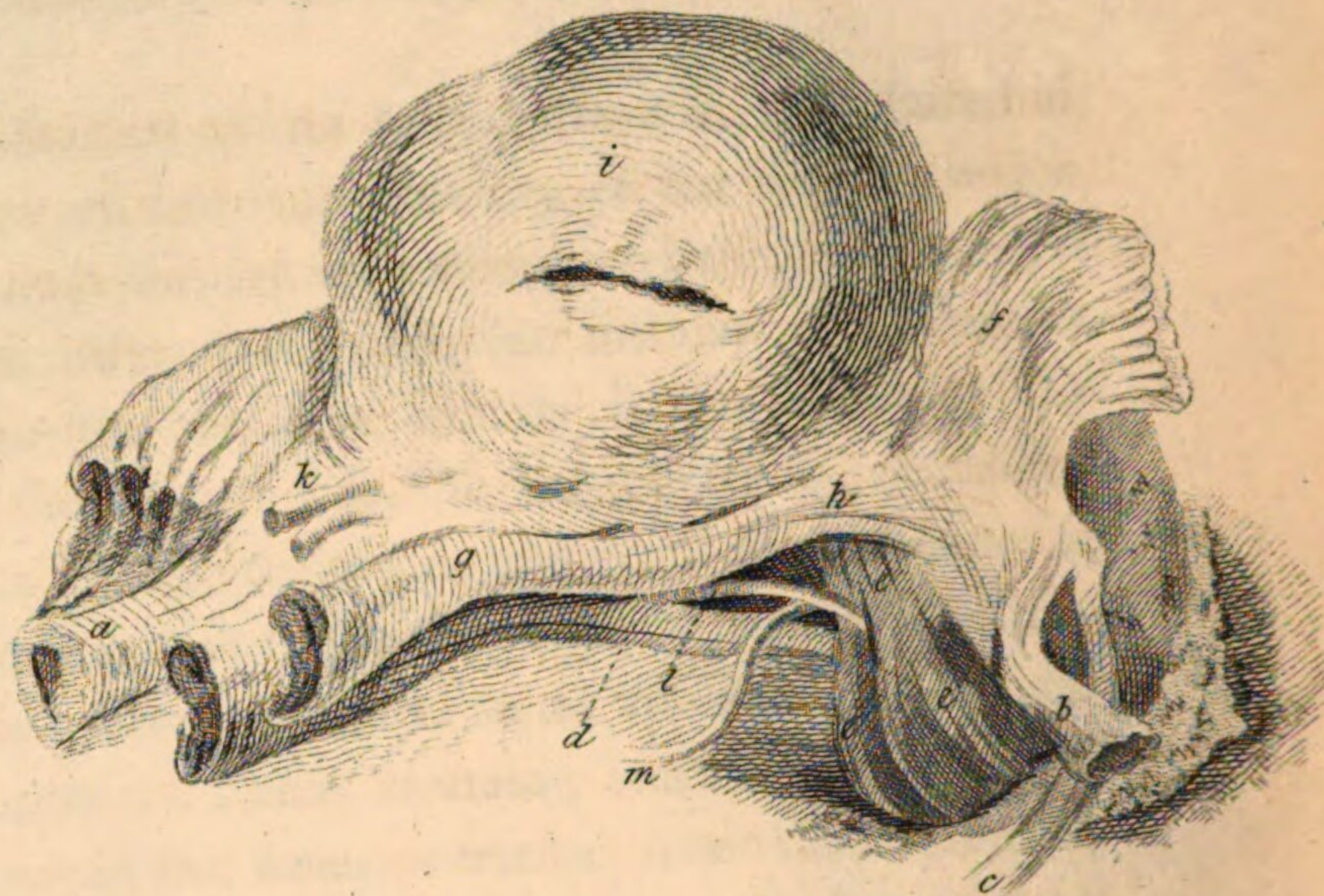


Fig. 5. p. 345.



Fig. 4.

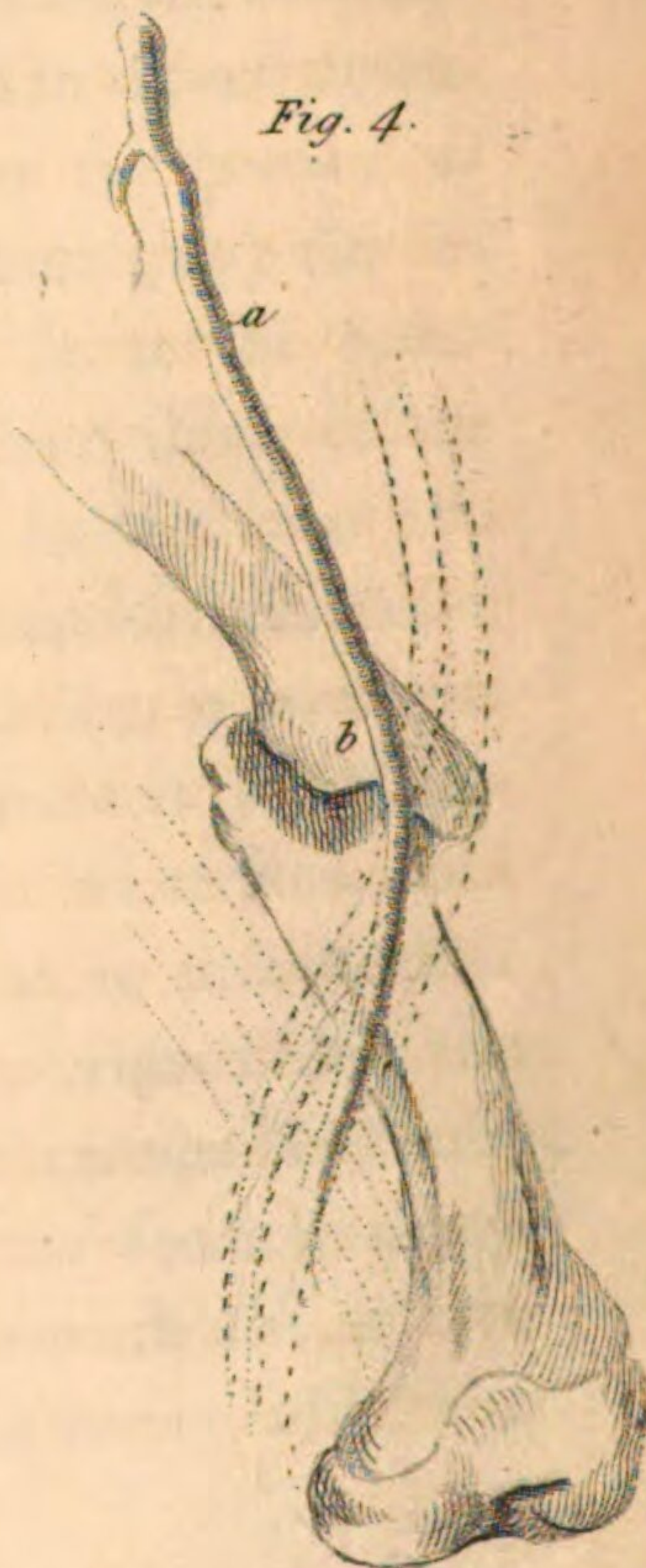
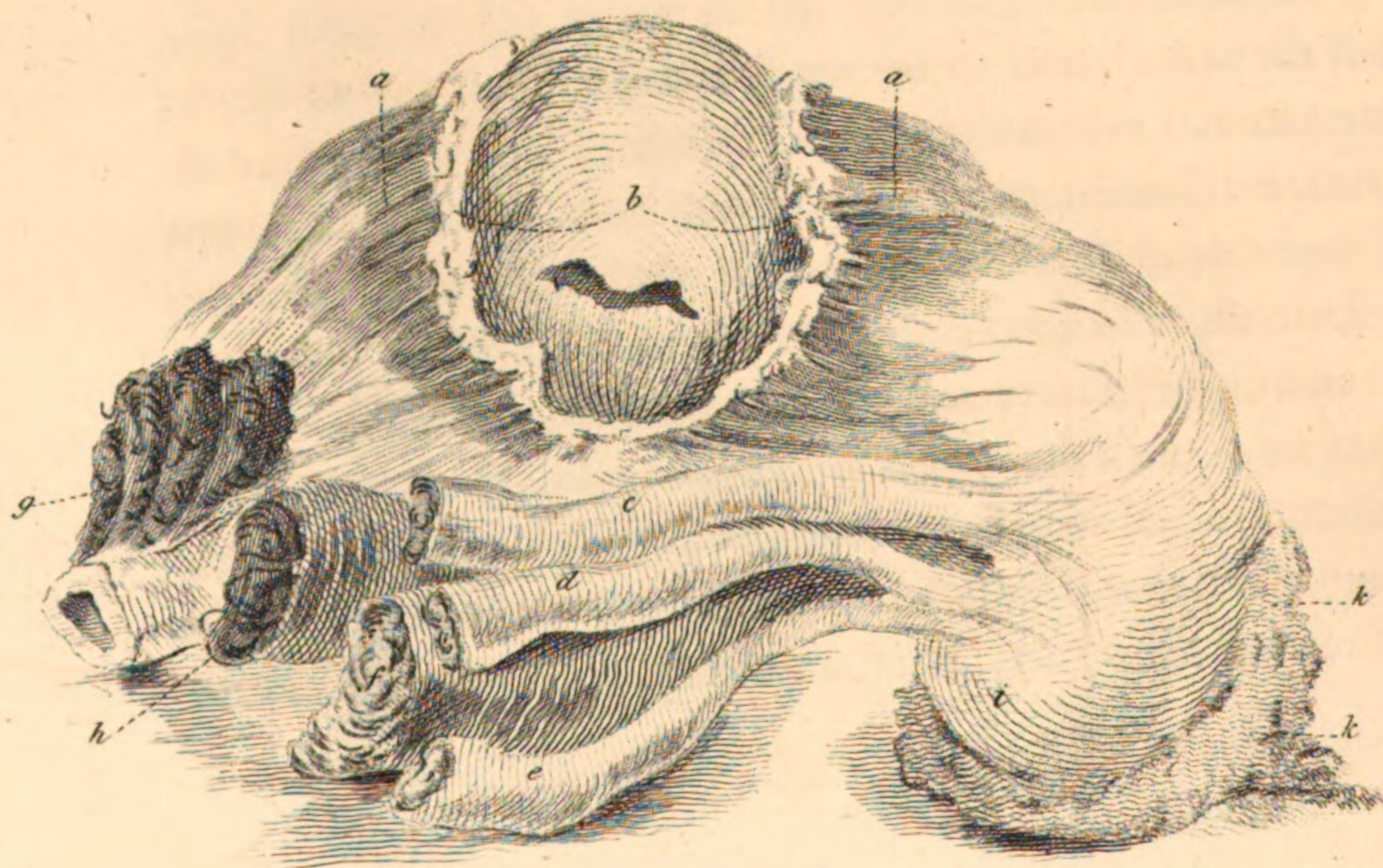


Fig. 1.



just after they have passed through the triceps and entered into the ham, and (m) is the popliteal nerve accompanying the artery and vein.

The aneurifmal sac which forms the most important figure in this sketch, though exceedingly firm, was so transparent, that when the vastus internus was dissected off from it, the dark blood was seen through it giving a purple tinge to the sac. The sac was round, about the size of three fists, and might contain from a pound and a half to two pounds of blood, partly fluid and partly coagulated.

Figure 3d presents those parts in a new posture; the aneurifmal sac is slit up, the found and the wounded parts of the artery are seen at once, (a) the triceps divides the aneurifmal sac from the ham, for it is the tendon of this muscle that divides naturally the fore from the back part of the thigh. The triceps adheres to the thigh bone in the line (a a), the aneurism is all before the triceps, while the vessels behind the triceps are found. (b) is the upper broken end of the thigh bone, (c) the lower broken end to which the triceps adheres, (d) the tendon of the triceps going down to the inner condyle, the letters (e e e) mark the aneurifmal sac plainly continuous with the periosteum, it consists of the cellular substance immediately connected with the periosteum, thickened, smooth, firm, and cartilaginous. (f) marks the found part of the artery where it has passed through the triceps taking the name of popliteal, (g) is one of the articular arteries singularly enlarged, as they all were; it must indeed seem remarkable that these arteries should appear so well filled with injection, since I could not venture to inject them till after much of the dissection was performed. (h) marks the artery and vein where they approach the sac, (i) marks their emerging in the ham, found and natural, (l) marks the corner of the sac under which lies the wounded part of the artery.

Figure 4th represents the idea I had of the breaking of this artery before the leg was ordered to be amputated. I imagined that the artery (a) passed obliquely across the hollow formed by the fractured end of the bone (b), and had been pressed by the muscles sartorius and gracilis, against the shattered end of the bone. I supposed it probable that when the patient slipped his foot, the muscles contracting strongly, and bending the artery across the ragged end of the bone, had fairly broken the artery across; but I find, upon dissection, that the artery is merely wounded, the wound is indeed half an inch long; the artery is left hanging only by a tag, no more than the fourth part of its circumference; the artery is in such a condition, that it must have been incapable of transmitting one drop of blood

for the nourishment of the limb, which, even from the moment of the fall, must have depended upon the collateral arteries. This is the great conclusive fact which makes all the phenomena of this case peculiarly important *.

That enlarged and active state of the whole muscular system of the limb, which I have hitherto proved by inference only, was demonstrated in this case; for the main artery was incapable of transmitting one drop of blood; the popliteal artery notwithstanding retained its full size; it retained its full size because of the number of enlarged inosculating arteries which opened into it; and those inosculating arteries which thus supported and filled the popliteal arteries, were the branches of the profunda; when the thigh was amputated, Mr. Harkness had to tie no less than fourteen arteries, every muscular branch bleeding like a trunk.

CONCLUSIONS.

Thus we see, that when a great artery is diseased or wounded, and an aneurism formed, there is no cure but that of the entire obliteration of that artery; and by whichever method we accomplish the cure, obliteration is invariably the effect.

Whatever physicians may have believed of their ponton, or bridge-like compress, affecting, as they supposed, the tumor only, and yet allowing the blood to pass along the artery; whatever they may have believed of their well-contrived springs and cushions for partial pressure; whatever the old surgeons may have attributed to those sponges, vitriol-buttons, pellets of chewed paper, or morsels of agaric, which, after cutting open the aneurism they applied to the wounded artery; in truth, they cured by compressing, destroying, cauterising it, and, one way or other, obliterating its canal; and I have just proved, that whatever the celebrated Guattani believed concerning the effects of his bleeding, spare diet, confinement, and well-supported compression, yet, in fact, he also obliterated each artery; and we may now take a slight review of the phenomena which present themselves according to the various ways in which this process of obliteration is effected.

First, If we tie the main artery of a limb, its blood being suddenly interrupted, the limb is cold for a moment, but its heat and circulation soon rise above

* The tinted drawing gives a true idea of the state of the aneurismal sac, &c. It is taken from the preparation. It has the colours of a preparation soaked in spirits. The parts will easily be understood, by comparing it with these plans; and in this drawing the preparation is so turned, that the laceration of the artery is seen distinctly.

Drawing of Mr Marknefses
Case of Aneurism

p.372



1. Femoral Vein
2. Femoral Artery
before entering into
the Sac
3. Femoral Artery lacerated
lying in the Center of the Sac
4. Popliteal Artery & Vein coming
out of the Sac & imbedded in the Cellular
Substance of the Ham

5. Ragged end of the Bone
by which the Artery was
lacerated
6. The Aneurismal Sac com-
ing off from the Periosteum
7. the Condyle of the Thigh Bone
8. Patella 9. Mucous Ligament
10. Semimembranosus 11. Semitendinosus
12. Gastrocnemii

J. Bell delin.

the natural standard. The blood no longer passing along the main artery forces the collateral arteries; these are excited to a high action, the limb becomes turgid, the animal heat rises high above the natural standard, and the limb continues for some days in danger of gangrene from intense circulation; but never does it approach in the least to that dry and cold gangrene from want of blood, which has always been so much feared! which has been, to the great loss of society, represented as the sure consequence of interrupting the main artery of a limb.

Secondly, When we compress an aneurism, the tumor itself is forced back upon the artery, the action of the main artery is suppressed, while the collateral branches are forced to receive its blood. When occasionally we intermit the compression, the blood returns to its old channels and the pulsation of the aneurism is renewed; but, by persevering in the compression, that channel is quite obliterated, and the cure is accomplished when the pulsation ceases on the fore part of the limb. Now, if this manner of obliterating the artery be not accompanied with the same interval of coldness and deadness of the limb that we are sensible of in using the ligature; if the same perceptible heat, turgescence of the limb, and high action of all its vessels do not succeed, it is because the tide of blood is more slowly turned, the collaterals slowly enlarged, and the course of the blood along the old channels is occasionally restored, in consequence of intermitting the compression at times, which happens rather from the accidental slackness of the rollers than from any premeditated design.

If this cure by compression be more successful in the aneurism of the ham, it is by the firm resistance of the bone against which the artery is compressed. If compression fails, and is sometimes dangerous in the thigh, it is because the bone is too deep to give full effect to compression, and the parts so soft that they allow the aneurism to spread in all directions; for in such cases, compression, instead of stopping the blood in the artery, rather diffuses the aneurism, forces the cellular substance, and inflames the parts.

Thirdly, When the cure is spontaneous, the process is still the same, and the proofs of the obliteration of the artery are as sensible as if we had accomplished it by ligature or compression. The dilating force of the artery and the resistance of the surrounding parts of the muscles, or of the fascia (for every artery lies under fascia) are balanced; the accumulation of the blood and the elasticity of the fascia begin to oppose the pulsation of the artery at the very moment when some proportion of the blood begins to be thrown upon the collateral arteries. The re-

stance of the tumor is increasing, while the force of the artery is diminishing. If before this balance of the resisting and dilating powers be complete, and the aneurism burst, then the man is gone, he dies of hæmorrhagy; but if the balance be fairly turned in favour of the circulation (through the collateral vessels) along the back part of the limb before the tumor bursts, then the tumor bursts without hæmorrhagy; the arteries in all the lower part of the limb draw their blood through the collateral arteries, and the most indirect rout for the blood becomes the natural one. This spontaneous cure also is perfect only when the pulsation of the aneurism of the great artery on the fore part of the limb ceases, and the pulsation being gone, the absorbents perform their office, the limb returns slowly to its usual form. This cure is also marked by a firm tumor, which is the residuum of the aneurismal sac, and a knotty and cord-like hardness, which marks the place of the obliterated artery.

The enlargement of the collateral arteries is the leading point then in every cure. From the very commencement of aneurism the circulation through the main artery is in some degree prevented. That difficulty increases daily, and so perfectly is the limb prepared for a change of circulation, that cut it off at what period of the disease you will, the number of arteries will surprise you. In this operation by Mr. Harkness, fourteen arteries were tied with the needle; and in an amputation performed by Mr. Allanson*, you will find that there had been even a degree of confusion from the number of arteries. "The large artery was taken up (says Mr. Allanson) without including the nerve; but this could not be done in all the others, which were numerous, for it was necessary to tie nine arteries."

What then is the condition of an aneurismal limb? is it in danger of wanting circulation? is it in danger of gangrene from want of blood? quite the reverse; all its vessels are enlarged, while one only, viz. the great trunk is destroyed or oppressed; the blood of the main artery is divided among innumerable small branches; the whole limb is turgid, throbbing with the intense action of these smaller arteries, now highly excited to work for the preservation of the limb; if, during this turgescence, this febrile state of the limb, you tie the main artery, the heat will immediately rise many degrees above the natural standard;

* P. 262. This was an aneurism of the ham, which was occasioned by a fall from his horse in a young gentleman of a pale and sickly habit. He sprained his knee in falling; the aneurism had grown about four months, and was now beating strongly as if it would burst, and it was beginning to be diffused up the thigh.

above the temperature of the sound limb ; if you cut off the limb those arteries will bleed from every point of the amputated stump. This limb is not cold ; does not need to be wrapped in flannels, nor rubbed with essential oils to solicit blood towards it ; its vessels are in no danger of being forsaken, but rather of being oppressed with blood ; the limb is indeed disposed to gangrene, but not of the passive kind ! If you perform the operation of aneurism, the wound you make will often fall into gangrene, but never without previous inflammation ; if you venture to amputate the limb you are still in danger of gangrene, it seizes upon the stump, but never without previous swelling, nor does the gangrene happen till the fifth or sixth day.

There is nothing more certain than that this aneurismal state of a limb predisposes to every danger, and it becomes us to look well to the facts and reasoning by which such a doctrine is established, for its influence over practice cannot be slight.

OF THE DANGER OF AMPUTATING AN ANEURISMAL LIMB.

The danger of amputating an aneurismal limb is familiarly mentioned in every book, yet amputation appears so much like giving the patient a chance for life, and the operation for aneurism is in itself so dangerous, that amputation is too often preferred.

When the celebrated Guattani was induced to try compression, it was because he was sensible that there were certain circumstances which would not allow of the operation for aneurism ; and he was particularly struck with the danger of amputation. " There were four cases," says Guattani, " of immense aneurisms in the ham in which I did venture to perform amputation ; but though the temperament, age, and strength of these patients, promised the happiest issue, they all died. Two were taken with convulsions, which beginning, as usual, in the jaw, extended down the back over the whole body ; while two others died of hæmorrhagy, which came on the second day after amputation *." This hæmorrhagy of which Guat-

* " Quod attinet ad amputationem, quatuor huc usque fuerunt amputationes femoris, quarum data occasione ingentium poplitis aneurysmatum ego periculum facere non dubitavi, sed omnes infelicem exitum habuere, licet temperamentum, ætas, satisque validæ ægrotantium vires mihi omnia fausta pollicerentur. Ex quatuor hisce ægrotantibus duo decesserunt, etiamsi optime se haberet ulcus, superveniente die septima supra decimam uni, alteri vero die septima atque vigesima inopinato, funestissimoque symptomate convulsionis, quæ ab inferiori, ut jugiter consuevit, mandibula initium capiens, et ad collum deinde, ad dorsum, ad pectus, universumque truncum porrecta, ægrotantes hosce, spiritu intercluso, peremit."

tani's patients died is just the commencement of that gangrene which I ascribe to the peculiar condition of an aneurismal limb, "for the hæmorrhagy came on (says Guattani) on the second, when the fever usually commences;" and though it stopped, yet it came on again next night in great profusion, and the patients died. He further remarks, and he laments it, "that after the death of the first patient, and when the hæmorrhagy returned in the second, he was so anxious as to lift the dressings from the face of the stump. He seems to have been struck with peculiar horror when he saw no one particular artery bleeding from the face of the stump, but every ligature firm. He replaced the dressings, and had little doubt of his patient being safe, but in the following night the hæmorrhagy returned, and this patient also died on the third day †." This general oozing from the face of the stump is just the beginning of that gangrene under which such patients always expire.

The result of Guattani's reflections on this subject is delivered nearly in these words: "Since there are certain circumstances in the condition of an aneurismal limb very unfavourable to operation, since we find that those who submit to have their limbs amputated die, since we see that sometimes aneurism of the ham is spontaneously cured, we should be resolute, whenever the circumstances are unfavourable to operation, to leave the affair to nature; at all events, it must be concluded from these cases (says Guattani), that amputation is no means of saving the patient ‡."

Let us compare this with any other gangrene. What is it that disposes a limb which has suffered a compound fracture to run into gangrene? If the ankle joint, for example, be luxated and fractured, the injured parts run into violent action, the blood is worked towards the inflamed part by the excitement of the vessels, and the whole limb becomes turgid and highly excited. If, after this inflammation be come on, you venture to amputate the limb; if you add another wound to this predisposition, you drive on the parts, already highly excited, to intense inflammation and gan-

"Duos reliquos interfecit aliud æque mortiferum, ac frequentissimum symptoma, nimirum hæmorrhagia. Hæc enim nocte operationi succedente, *qua febris ut plurimum excandescere solet*, utrosque invadens, illos quidem postea dimisit; sed nocte proxima iterum eosdem adorta ita illorum vires attrivit, ut, exunte die tertio, animam uterque exhalaverit."

"† Verum mirifice obstupui, cum firmas, immobilesque singulas vasorum cernens vincturas, ac ne minimam quidem inde emanantem cruoris guttam conspiciens, nil aliud mihi reliquum esse cognovi, quam modo ademptum pristinum apparatus instaurare."

"‡ Ex quatuor tandem amputationibus hæc satis efficere posse videor, eas præsidium illud non esse, a quo merito adduci in spem valeamus, illius ope nos ægrotantes ejusmodi allevaturos."

grene! that condition which caused the actual gangrene in the lower parts of the limb, predisposes to it in all the upper parts! To amputate such a limb is to add wound to predisposition; the muscles appear dark-coloured in the moment of amputation; the vessels which throw out blood, and require the needle, are almost as numerous as in an aneurismal limb; inflammation immediately seizes the stump, gangrene comes on the third or fourth day! when the stump sloughs, the vessels begin to bleed, the blood flows from the whole surface, and with the fever, gangrene, and loss of blood, the patient expires on the fifth or sixth day.

There is nothing with which the condition of an aneurismal limb may be more aptly compared than this predisposition to gangrene. It signifies little whether, in a fractured limb, the lower parts be so injured that the inflammatory action of the parts solicits blood along the vessels of that limb, and makes it swell; or whether, by the obstruction of its main trunk, the blood is forced upon the smaller arteries, so as to bring the limb into what I have called the Aneurismal condition; inflammation and a predisposition to gangrene are equally the consequences of either state; and this predisposition to mortification in an aneurismal limb, is matter of common observation: surgeons have cut off too many aneurismal limbs to be ignorant of this danger; and, as Mr. Ford very properly observes*, "Amputation, in the case of aneurism, is not among the happiest efforts of surgery." I surely do not affirm that every one will die who has his limb amputated for aneurism; a degree of danger is all that I maintain; and that the gangrene is not of a passive kind; that it arises from active inflammation.

If, in mortification of the lower parts of a fractured limb, we wait for the signs of separation, we wait, in fact, till the turgid and active state of predisposition is over, and then amputation is safe; but if we amputate a limb turgid, inflamed, and in this state of predisposition, gangrene seizes the stump; and if we amputate during the turgid state of an aneurismal limb, we run precisely the same risk of gangrene.

OF THE DANGERS OF PERFORMING ANY KIND OF OPERATION ON AN ANEURISMAL LIMB.

If amputation be not among the happiest efforts of surgery, the operation of *aneurism* is, in certain circumstances, almost inevitably fatal. We have reason to believe, that in the common accident of compound fracture, it is the gorged and excited

* Vide A paper of Mr. Ford's in the London Medical Journal.

state of the whole limb that predisposes to gangrene; that while such a state of the limb prevails, gangrene will attack the stump, however high we may choose to amputate the limb. We are also satisfied, that a similar affection takes place in the aneurismal limb; its vessels are enlarged, gorged, and highly active, the limb swelled, and I do not know why we should not say, inflamed. We are well assured by every kind of proof, that the inosculating arteries of the limb are fully equal to the supplying of the limb with blood, yet the disease of aneurism is often fatal by convulsions, fever, bursting of the tumor, and irresistible hæmorrhages. If left to itself, the limb seldom dies of gangrene. When gangrene seizes upon the stump, it is from adding a great wound to this state of predisposition, not surely from obstruction of the great artery.

When we apply the same reasoning to the operation of aneurism, we perceive, that here also we are adding a great wound to this predisposition; nor can we be surpris'd if, in the moment of stopping by ligature the main trunk, and enlarging of course all the collateral arteries, if in the moment of throwing the limb into this state of predisposition, we make a large incision, and dig deep to get at the aneurism, the limb falls into gangrene! it would indeed be almost a miracle if such limb should escape. We are sensible that the gangrene, when it does come on, is of that kind which succeeds high inflammation, for the gangrene accompanies that increase of heat which follows the tying of the main artery. We are also sensible, that the gangrene comes on after the limb is safe in respect of its circulation; for once, when Guattani was performing the operation for aneurism in the ham, he found it difficult, on account of the confusion of parts, to tie the lower ligature, the blood flowing impetuously from the lower artery, Guattani "takes occasion to reprove those who are careless of applying the lower ligature *; he blames himself too, and acknowledges, that in this case the blood which escaped from below unquestionably came round by the inosculating branches to this ill tied part of the artery †." Yet this patient, after this absolute proof of the enlarged state of the inosculating arteries, and of free circulation

* "Me pariter nequaquam præterit, quosquam esse ex Chirurgiæ Professoribus, qui superius Arteriæ vinculum dumtaxat præcipiant, de inferiori nihil solliciti, putantes forsan in compressione satis præsidii esse ad profluentem sanguinem cohibendum."

† "At turpiter hi profecto falluntur, non secus ac egomet in prædicto ægrotante deceptus sum. Sanguis enim, quem ab inferiori vinculo prodiiisse admonebam, extra omnem dubitationis aleam ille ipse fuit, qui per furculos laterales ad male revinctam delatus erat arteriam." P. 118.

of blood in the limb, died on the second day of irremediable gangrene *. In the Medical Essays †, we find a patient dying of aneurism, of whose situation we have this short note: "That for *three days* every thing seemed to do well; that there was a kindly warmth of the foot, and no more fever than was to be expected from such an operation. Then, on the fourth day, the patient began to sink, the foot to feel cold; then a gangrene appeared *in the sides of the wound*, and he expired on the sixth day."

We now see that this gangrene which follows the tying of the artery in an aneurismal limb, comes on after the inosculation is enlarged, and the free circulation of the blood established, after the kindly warmth is restored, after the limb has survived four or five days, and the gangrene begins, not in the great toe nor foot, but in the edges of the wound, where injury is added to predisposition.

But besides this general predisposition to gangrene, there are other causes which make the operation singularly unsuccessful; and I must now remind you of the frequency of aneurism in the ham, and of the peculiar dangers and difficulties of that kind of aneurism. The popliteal artery lies close upon the knee-joint; the heads of the gastrocnæmii muscles, with the borders of the two hamstring muscles, form a deep triangular hollow, which the aneurism occupies; there it is soon straitened, and, by the pressure, a caries of the bones is produced, such as defies surgery, such as has often been the occasion of cutting off the limb after the operation for aneurism had been begun. You will next observe, that there is no getting at the artery itself, which lies under the aneurismal tumor, without the deepest incisions; and often it happens that the ham is so disordered, that no incision will admit you to the artery. The very best operators, as Mr. Pott and the celebrated Guattani, have been obliged to forsake the operation in the ham, to cut across the tendon of the triceps muscle, and to take up the artery on the fore part of the thigh, after having begun the incision with hopes of tying it in the ham. Concerning such an incision Guattani might well say, *Ex tam immani vulnere*. The incision must be immense: an incision like this, of a foot and a half in length, and passing deep into the substance of a diseased limb, may well account for that gangrene which is so frequent.

You will next observe, that cut in whatever direction you will, there is no

* "Postridie etsi torcular haud esset adstrictum, gangrænam articulis minitabatur irreparabilem quæ die proximo ægotantem de medio sustulit."

† Page 220, Vol. III.

avoiding those very arteries which after your operation should support the limb! You must go straight forward! The tourniquet is screwed, you see no arteries beating, nor indeed could you avoid them, for there is no part of this joint that is not furrounded with the most important branches; you must wound them; and very singular consequences arise from the various accidents of these articular arteries. If, in a natural aneurism or mere dilatation of the popliteal artery, the sac be cut open, these inosculating arteries, whose mouths open upon the internal surface of the sac, and belong originally to the dilated portion of the artery, as in Figure 1st, will bleed from uncertain parts of the sac; or when the sac is opened, though no such arteries run into it, yet, by joining the artery below the sac, as in Figure 2d, their blood comes by a retrograde course up from the tibial and fibular arteries, through the lower end of the artery. This is frequently the



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cause of secondary hæmorrhagy. Again, when the artery is tied on the fore part of the thigh, without any incision into the sac, the pulsation, though it stop the instant the ligature is tied, may return the second or third day, from the increasing power of those collateral arteries, which enlarge more and more from the moment of the operation, and soon acquire such a size as to fill the aneurismal sac; and when the sac is thus filled, a number of small arteries will give it a pulsatory motion, as if the ligature upon the main artery had given way! It was such a pulsation that so alarmed Mr. Pott that

he immediately cut off the limb: but this secondary pulsation is not a mark of danger; it is, on the contrary, a sure token of success. This retrograde blood

will be easily opposed by a slight compression ; and the inosculating arteries thus filling the tumor again, is a sure sign that they are capable of nourishing the limb.

Lastly, These arteries thus circling in every direction round the tumor and round the joint, belonged originally to the surrounding parts ; their branches still (while performing the more important office of supporting the limb), nourish those parts to which they originally belonged. These branches cannot escape the knife ; and the cutting of the smallest of their branches must empty those inosculating arteries, which should serve as trunks to the limb. But, worse than all, the articular arteries themselves are cut in making way into the aneurism of the ham ; the incisions pass through the muscles and the muscular branches ; the needle, before it encloses the popliteal artery, must be driven down to the bone ! By the cutting of those inosculating arteries, blood wells out from all parts of this deep wound, and a hæmorrhagy comes on, which is not to be subdued but by thrusting down sponges into the bottom of the cavity, and cramming it with lint. Thus the enlargement of those inosculating arteries, which we thus have considered as an inestimable advantage, constitutes the chief danger of the operation, the only one, indeed, which a good operator cannot escape. This is the kind of secondary hæmorrhagy so often mentioned, and so little understood ; these are the arteries whose bleeding has forced the surgeon sometimes (unable to command them) to cut off the limb ; these are unquestionably the arteries which filled up the sac again, and produced a new pulsation in that operation of Mr. Pott's, which has been so invidiously commented upon. These very arteries which the surgeon wishes so anxiously to have enlarged, spoil his operation. If gangrene ever arises from want of blood, it must be rather from the cutting of those articular arteries which should save the limb, than from the interruption of the main artery, on which it no longer depends.

I wonder only that this operation for aneurism of the ham has ever succeeded. There is here represented such a combination of circumstances unfavourable to this operation, as to entitle the surgeon, when he does succeed to rank the cure, “ among the successful *efforts* of surgery.”

OF THE SAFETY WITH WHICH WE OPERATE ON THE FORE PART OF THE THIGH.

The operation proposed by John Hunter, is one of the most important improvements in modern surgery, and one which only a great surgeon could.

invent. The superiority of this operation consists not in escaping that part of the artery which is diseased, for the yielding of the artery depends upon very different causes, and is to be prevented by precautions very different from this of changing the place of operation! I shall be able, indeed, to prove, that the artery of a young and healthy subject gives way almost as frequently as that of the aged or diseased. But, in Mr. Hunter's operation, you imitate the natural and spontaneous cure; the limb is prepared for that change, which you mean to complete by your operation; the main artery is compressed by the aneurism; the collaterals are enlarging; nature has begun a process with which it is dangerous to interfere, which you are to complete; you cannot with prudence make an incision into the diseased mass; you would not choose to cut the parts which are supplied with blood by those very anastomoses which you wish to save. In Mr. Hunter's operation, you make an incision in the fore part of the thigh; there you tie the artery far above the aneurism; you stop the blood, and throw the whole circulation upon the anastomosing arteries; you but complete that process which nature had begun, and leave the absorption of the tumor to time.

You make this small and superficial incision (hardly three inches in length) upon the fore part of the thigh, above the part of the limb affected with aneurism, and of course you have no thickness of parts to cut through, except what arises from the general oedema of the limb. Your first incision is through the skin, your next is through the strong fascia of the thigh; you encounter no anastomosing arteries, you deprive the limb of no one blood-vessel, except the great artery, which it is at any rate about to lose, and which is already much compressed; you make no disorder in the limb, you touch no diseased part, you have no deep digging for the artery, you have no difficulty, no uncertainty in tying it, you run no risk of secondary hæmorrhagy, at least from the articular arteries; you make no incisions among parts which are choked with extravasation, where the muscles themselves seem hardly more alive than the coagulated blood which they contain; you expose no joint to ulceration, nor any bones to caries. Far from increasing those disorders which are within the injured part, you rather take away the cause of disorder, by preventing any further effusion of blood. Your incision is small, your way to the artery is direct; you feel your way by the pulse of the artery, and are assisted by your knowledge of the parts; if you be really an anatomist, you must perform this operation in a few minutes; if you be not, and

dare to undertake such an operation, I know of no punishment too severe for such unprincipled conduct; no human reproaches can touch a mind which does not feel the punishment within*.

OF THE OPERATION OF TYING A GREAT ARTERY; WHY THE LIGATURES SO OFTEN GIVE WAY;
AND HOW THE ARTERY WILL BE BEST SECURED.

We have now brought this subject nearly to its conclusion; but this last point is, indeed, the most interesting, viz. the way of securing the artery. We are assured that the limb is safe, in respect of the supply of blood; the collateral infusculating arteries are enlarged; they are, from the first moment of the aneurism, in the habit of transmitting blood, and in part, at least, of supplying the limb; and we return once more to this interesting question, "Why does the artery give way, for that alone is the cause of death? Why is there such a difference in the securing of an artery tied in aneurism, an operation so full of difficulty? and in amputation, an operation so perfectly safe, that the death of a patient would be a flagrant disgrace?"

Mr. Home, in describing the operation proposed by Mr. Hunter, says, that "if we consider the cases in which the common operation for popliteal aneurism has been performed, and when the patients have died, we shall probably find, that in all of them the artery has been diseased at the part enclosed by the ligature, and had either sloughed off, or had been cut through where it was tied †," &c.

I am now to demonstrate to you, that the yielding of the artery arises from no such cause. I am now to recur to those principles which I laid down in my first Discourse on Aneurism, and am to prove what in a former discourse I only affirmed, "That by insulating the artery, tearing it up from its cellular substance, and keeping it for ten or fifteen days detached from all the surrounding parts, it can do nothing but gangrene below the ligature, and ulcerate and burst above." Unless those fatal hæmorrhages from bursting of the artery be owing to our manner of tying it, I know of no cause to which they can be ascribed; you may, indeed, be assured, that there is something faulty in our manner of tying the ar-

* I have known an operator grope for half an hour before he could get at the femoral artery in the sound part of the thigh.

† *Vide* London Medical Journal. Those notions of the pathology of a wounded artery are far from being the most correct. Every artery tied with ligatures must both "slough off and be cut through."

tery, and that its yielding does not proceed from disease! for in recent wounds, the artery is as apt to burst as in cases of old aneurism proceeding from natural dilatation; and it has given way as often when tied according to Mr. Hunter's method, on the fore part of the thigh (far from the seat of disease), as when tied in the cavity of the ham itself, after much painful dissection. Having witnessed the most terrible hæmorrhages in young people, and in recent wounds where I saw and fingered the femoral artery, I am well assured that disease is not the cause of its yielding; and having observed how seldom the artery gives way in an amputated stump, I think I dare affirm, that with good conduct and care we should be able to command any artery.

I proceed, then, to analyze the several operations which have been performed upon the femoral or popliteal artery, and shall endeavour to prove, First, That the more pains the surgeon takes in securing the artery, the more does he insult the artery, destroy its vascular connection with the surrounding parts, and endanger ulceration and bursting. Secondly, That the oldest method of all, recommended by the Arabians, and practised even by modern surgeons, viz. the cutting the artery across after it is tied, is in truth the only operation which can give to the artery tied in aneurism the security of an artery tied in amputation of the thigh. The first part of my duty, then, is to enumerate those faults in the manner of tying the artery, from which so many have lost their lives, and so many of the best surgeons have failed in their attempts to secure the femoral artery.

The English surgeons were among the first who attended to this important piece of surgery. Mr. Hunter suspected, that a diseased state of the artery was the cause of its giving way; for this reason alone did he change the place of operation; but even when he tied the artery on the fore part of the thigh, far from the seat of disease, the artery gave way as frequently in his own practice as in the older way of operating.

This doctrine has universally prevailed, "That it would be better even to *prevent the wound healing* after the tying of the artery, and keep it open and in a state of suppuration, by which means the operator would have it more *in his power to come at the artery, should that be necessary*; he might also, in dressing this open wound, have it in his power, by gentle compression, to assist the ligatures *." This is professedly the principle of Mr. Home; and this most danger-

* See an Account of M. Hunter's Operations, by Mr. Home.

ous doctrine led directly to those very precautions which, instead of ensuring the obliteration of the artery, caused its ulceration and bursting; for, as it was thought advisable to lay compresses within the wound to support the ligature, it became important to have a considerable length of the artery exposed. The surgeon was too sensible, from experience, how apt this operation was to fail; and though he could not suppose that the laying much of the artery bare could contribute to its security, yet he wished to have a command of it; he wished to see it when it burst, and to be able to draw his ligatures again, or to drive his needles under it a second time, if necessary. Accordingly, he laid relays of ligatures under the artery, that it might never be out of his sight, although, in truth, till the artery be out of sight, buried among the flesh, it can never be safe.

Another theory still more subtle was this. The ligature, as some affirmed, should not be drawn tight; it should, say they, be straitened in such a degree only as to moderate the flow of blood through the artery, but without suppressing it altogether; or, to use Mr. Home's words, "A ligature being made upon the femoral artery impeded the passage of the blood into the sac *so much*, as to allow it in *some measure* to collapse, and its contents to *coagulate* *."

While the theories were so very imperfect, the practice could not be good. There are two purposes here distinctly marked: First, That the surgeon should have it in his power at all times to open the wound, to look into the bed of the artery, to touch his ligatures, to draw the knots tighter when at any time they seemed loose, or to tie the occasional ligatures, when the first ligatures chanced to give way: Secondly, Since the purpose of the operation was not to interrupt, but only to moderate the flow of blood, it was judged better to accomplish this by a succession of ligatures slightly drawn, than by a single ligature firmly tied. The operation was, indeed, such as accomplished these two purposes perfectly; the artery could always be seen, the ligatures could always be found, the strings or tapes lay thus under the artery for fifteen or twenty days, and the artery thus insulated never failed to burst, so as to give the operator a fair opportunity of trying the strength of his occasional ligatures, and of adding, besides, whatever ingenious inventions he could fall upon.

The operation of tying the artery was performed by Mr. Hunter in the following manner: "Having disengaged the artery from its *lateral connections* with the knife and from the *parts behind it*, by means of the end of a thin spatula, a double

* London Medical Journal, 1787.

ligature was passed behind it by *means of* an eyed probe, and the artery tied by *both portions* of the ligature, but so slightly as only to compress the sides together; a similar *application of ligature was made* a little lower;" and the reason for passing four ligatures was, "to compress such a length of artery as might make up for the want of tightness, as Mr. Hunter chose to avoid great pressure on the vessel at any one part*." The result of this operation was what one might easily have prognosticated, viz. that the patient was in extreme danger of his life. "On the ninth day after the operation there was a considerable discharge of blood from the part where the ligatures passed out; a tourniquet was therefore applied on the artery above, which stopped the bleeding; and although the tourniquet was taken off a few hours after, no blood followed. The head of a roller was now placed upon the wound in the direction of the artery, which was not tightened more than was thought sufficient to take off the impetus of the blood in that portion of the artery." Thus we see, that the issue of this operation, even in the first and most successful case, was a bursting of the artery; from which the patient was saved perhaps by a clot of blood forming in the artery, maintained by the continual pressure of a half screwed tourniquet; thus we find the artery giving way, although tied far from the seat of disease; we find nothing in the narrative of the case implying, that the operator, while tying the artery, felt it crisp, hard, enlarged, or anyhow inclined to disease; we find the artery not giving way till the ninth day; and you will presently be satisfied that it is generally betwixt the ninth and the fourteenth day that the artery bursts, as if its bursting were the consequence of some regular process of inflammation and ulceration, and happened always at a certain stage of the disease; you will find the artery bursting always at the very time when, if tied and cut across, and put in the same condition with the artery of an amputated limb, it should be past all danger.

Next after Mr. Hunter, the inventor of the operation, Mr. Birch performed it in St. Thomas's Hospital; and he improving upon these methods of insulating the artery, seems to have stripped it down very carefully betwixt his finger and thumb. This was done in the case of one John Lewis, a negro, whose aneurism arose from a blow upon the fore part of the thigh. "After cutting the fascia," says Mr. Birch,

* An account of Mr. Hunter's operations for the popliteal aneurism, in a letter to Dr. Simmons, by Mr. Home, p. 395. Had Mr. Home reflected a moment on the manner in which his four ligatures came away, without the loops of them being cut; he might have learned, that they did something more than moderate the force of the blood.

"the finger and thumb could surround and compress the vessel; an eye-probe, armed with a *strong ligature*, was then pushed through the cellular membrane, and carried under the artery. This being effected, we had such command of the vessel as to be able to *strip it down*, and pass another ligature somewhat lower. The last ligature was then tied, *the first being left loose to secure us against accidents.*" These unhappy contrivances for securing the artery, are in truth the causes of accidents. What was the issue, for example, of this case? On first reading it, we should believe, that the secondary hæmorrhagy of which the patient died, had proceeded only from the bursting of the aneurism; but we soon see, that here also the artery itself had given way. It was on the eleventh day after the operation that the patient expired; and upon dissecting the limb it was found, "that water, injected by the internal iliac artery, escaped freely from the wound at the ligature, where the artery was open, and appeared to have ulcerated at that part; and in flitting up the artery from the ligature to the heart, its internal surface appeared of a bright red." Thus the inosculations are in such cases enlarged, the heat restored, and the limb safe; gangrene is not the cause of death; the patients die of hæmorrhagy; they die not on the third or fourth day, of gangrene; but on the fifteenth or twentieth day, of hæmorrhagy; they are lost, not from the want of the provisions of nature against interrupted circulation, but from the imperfection of our operations*.

The report of this method of operating having passed over to Paris, the French surgeons of La Charité improved with singular ingenuity upon the mistakes of

Artery tied with four Ligatures



* The condition of the artery, as tied with these successive ligatures, may be represented by this plate, where the ligatures (a a) are drawn firm, and have killed the piece of artery (b), where the ligatures (c c) are either drawn very slightly, to prevent the too violent impulse of the arterial blood against the others, or are merely laid under the artery, to serve in case of the artery giving way at the first ligatures. But the sure effect of such relays of ligatures is, to detach the part (d d) of the artery from the surrounding cellular substance; it must die along with the portion (b), or, falling into a state of ulceration, it will burst. The second ligature at (c) may then be tied, and will stop the artery for a time; but that part of the artery is inflamed, the part under the second ligature is in a state of ulceration; the process of ulcera-

the English surgeons. They will pardon my allowing them only the second place, though they seem very well inclined to steal into the first, and to take to themselves the whole merit of these improvements, such as they are *.

M. le Comte invented a way of curing wounded arteries which has been admired as ingenious. He slit up a quill on one side, which, when unfolded he applied to the artery, and allowed it to close again, so as to encircle the artery; and in order to compress the wound of the artery with better effect, the quill was lined with a very fine ribbon, and the ends of the ribbon served for tying the artery. This proposal was received by the Medical Society of Paris with some degree of applause, and a committee was appointed to make experiments. But the process which goes on in an artery thus insulated was not considered, or else the event of such experiments might easily have been foretold. An artery being thus surrounded with a foreign body and completely insulated, must undergo one of two changes: First, If firmly compressed, as when we apply the common ligatures, drawing them tightly, it would be not merely obliterated in its canal, but entirely cut across, and accordingly the ligatures would come away on the fourth or fifth day: Secondly, When thus encased in a quill, it would probably only inflame, its coats would thicken, the blood would coagulate above and below; the artery would continue alive, but by this inflammation and thickening of its walls, its canal would be obliterated, and the course of the blood in it be as effectually stopped as if it had been cut across by a ligature drawn firm.

This accordingly was the issue of the experiments performed by the Committee upon Animals; they generally found the canal of the artery obliterated; it was

tion, far from being stopped, will be accelerated by tying this second ligature, so that in its turn it also will give way, and the patient bleed to death. It would appear, that when an artery is once brought into this state of ulceration, the danger does not end with the failing of the ligatures; for in the second operation performed by Mr. Hunter upon a trooper, the ligature came away on the fourteenth day; on the twentieth a slight bleeding came on, and a few hours after the hæmorrhagy returned, and he lost a pound of blood before the tourniquet could be applied. The artery was then laid bare, and tied a little higher up, but too late, he fell very weak and low; on the twenty-third day he bled again, and on the twenty-sixth the bleeding returned, he became faint and delirious, hickup came on, and he expired. This is a sad story. The patient was a young man; the artery was tied in the sound part of the thigh; it was tied, indeed, simply enough; but the cause of this hæmorrhagy is sufficiently obvious: "Upon examining the limb, sinuses were found running along the bed of the artery, upwards and downwards, and along the Sartorius muscle, besides smaller ones (i. e.) abscesses, in different directions.

* *Vide* Fourcroy, Vols. II. & III.

only in one experiment that they were able to inject the artery after the death of the animal, and in that case too the artery was contracted at the place where the quill had been applied. In short, the effect of this operation, as of all others, was to obliterate the artery. We have even reason to believe, that if a wounded artery were ever cured by stitching the lips of the wound together, the cure would be accomplished only by inflaming the artery, swelling its coats, and obliterating its cavity; for that operation which was first proposed by Mr. Lambert of Newcastle, and afterwards repeated by me, has since then been repeated in the way of experiment by Conrad Asman, in presence of Boufch, Allardi, P. Driessen, and others. These gentlemen have invariably found the canal of the artery quite closed; and in pushing probes or Annell's wires along the course of the obliterated artery, they have usually found, that at the point where the wire was stopped by the adhesion of the coats of the main artery, the point of the wire turned off easily into a collateral branch, which was proportionably enlarged *. Nor have they found the experiment to be even a harmless one, nor this way of obliterating the artery a good substitute for the ligature: for the inflammation which obliterated the artery at the part where the blood was no longer allowed to pass, sometimes proceeded to ulceration in the parts beyond, so that the artery burst, with a dangerous hæmorrhagy †.

It was next proposed by Mr. Perfy, when the femoral artery was wounded, to cut a piece of sheet lead, slip it under the artery, and roll and bend it so as to encase the artery like the quill of Mr. Le Comte. This is another piece of ingenuity which must have been attended with still more serious consequences. The rudeness and weight of such a sheath for the artery, however it might have obliterated the wounded point, must have ulcerated the adjacent parts. This is a contrivance so coarsely mechanical, so directly opposite to those provisions by which nature secures a wounded artery, that it is the very thing one would have supposed in ridicule of these various methods of insulating the artery. It is a very singular proof, that the more ingenious surgeons have been in their mechanical contrivances, the farther have they departed from the principles of surgery.

* Ex nostris itaque experimentis summa, cum prudentia institutis concludendum esse puto operationem Lambertianam ligaturæ, non præstantiorem esse; sed minus certam et minus tutam; atque si succedit nullo alio modo, quam arteriæ coalitionem et quidem per satis longum tractum, inducendo, hæmorrhagiam sistere, nihil itaque magis, quam ipsa ligatura efficere.

† In nostris quoque experimentis experte fuimus hæmorrhagiæ lethali ansam dare.

When Mr. Duschamps had occasion to perform the operation for popliteal aneurism, he, like a man of real honour and good sense, went into the Salle-des-Morts with his friends the evening before his operation, made various experiments, and settled with his assistants the manner of his operation, and all the steps of it. He, a man of knowledge in his profession, did what an ignorant fool would have been ashamed to do, tried the operation first on the dead body. Mr. Choppart, previous to an operation which he performed, had made trial of this piece of sheet lead, but was dissatisfied with it, and applied the ligatures in the common way. Mr. Duschamps also rejected it. "In respect (says Mr. Duschamps) to the confidence which Mr. Lewis had, in this manner of securing the artery, I also made trial of it the evening before my operation, but whether from my awkwardness, or the imperfection of the method itself, my assistants disapproved of the experiment, and recommended it to me to hold to the old operation with ligatures."

But it was not from principle that Mr. Duschamps rejected this invention, it was not because of the dangerous effects of this rude contrivance in insulating and ulcerating the artery, he rejected this only to make way for a contrivance of his own still more mechanical, more complicated, more ingenious, and in proportion more dangerous. "A young man having wounded himself with a pair of scissors in the femoral artery, Mr. Duschamps unfortunately made a false incision, he exposed only the entire side of the artery! the side opposite to that on which the artery was wounded, the wounded part of the artery could not be seen, and the artery was so well supported by its cellular substance, that it continued full and pulsating strongly. After long searching in vain for the wounded part, Mr. Duschamps applied a ligature at random, that ligature chanced to be below the prick in the artery, and no sooner was the blood thus opposed than it rushed out. This directed Mr. Duschamps in placing the second ligature, he applied it above the place of the bleeding, and a compress being laid upon the artery, every thing continued secure; by the third day the limb had quite recovered its natural warmth and feeling, and on the fourth, the dressings were moistened with a ferrous effusion, and the digestion of the wound was begun; but on the seventh day, there came on a considerable hæmorrhagy, and upon lifting the dressings, the ligature was found relaxed, so that it could not have the smallest effect upon the artery. The impossibility of drawing the loop of this ligature made Mr. Duschamps apply a second a little higher upon the artery. He found it very difficult to draw it tight enough to stop the blood, yet at last he did accomplish it,

but the following evening it burst out again, the dressings were lifted, and the ligature was found a second time relaxed. In these circumstances, Mr. Duschamps resolved to prolong his incision, and tie the artery a little higher where it lies more superficially, he applied the ligature, and once more suppressed the bleeding with very great difficulty, for they were obliged to draw this third ligature fully as tight as either of the former. Still the blood rushed out from time to time the whole of that day and of the next, which was the tenth from the operation."

"These repeated hæmorrhagies having reduced the patient to extreme weakness, his pulse fluttering, and his face deadly pale, so many ligatures having failed successively, made Mr. Duschamps despair of saving him. It was now necessary, says Mr. Duschamps, to contrive some engine by which not only the artery might be compressed, but the ligature tightened from time to time in proportion to the fading of the parts; and now such operations became particularly difficult, for the parts were greatly swelled, so that the artery lay very deep."

He contrived an instrument of silver, with a flat button and a stalk; the stalk allowed the instrument to go down to the bottom of the wound, the flat button was to rest upon the artery as a smooth compress, and in the button were two slits through which the flat ligature surrounding the artery passed, the ends of the ligature being tied with a knot over the top of the stalk, and tightened as occasion required. Before the instrument could be made and prepared the artery had begun to bleed again, the dressings were then removed, the ligature was found quite slack, and was therefore cut away. There had been an occasional ligature laid under the artery higher up than the proper ligature, and that occasional ligature (ligature d'attente) now served for conducting a fresh tape under the artery, this tape was passed through the slits in the machine and tied over the top of the stalk, it suppressed the pulse in a moment, and from that time there happened no hæmorrhagy, and the man recovered."

Here there was no disease nor tendency to disease; the patient was a young and healthy man, wounded recently with the point of a pair of scissors. But the artery lay for ten days exposed and quite insulated, the bed of cellular substance which surrounds it quite destroyed, and the artery inflamed and ulcerating at the point where the first ligature was applied; this proves, that the applying ligature after ligature higher upon the artery, serves but to propagate the disease; in this case, each successive ligature as it was applied higher and higher along the artery

made it ulcerate and burst anew ; the machine which Mr. Duschamps calls his *Serre-Artere*, seems alone to have been effectual.

How little this method of Mr. Duschamps was founded on the true principles of surgery, I leave you to judge ! how little it differed from the quill of Mr. Le Comte, the piece of sheet-lead of Mr. Perfy, or the four ligatures of Messrs. Hunter, Home, Birch, Pott, and the other English surgeons. But I must explain to you how far it is from being secure.

The second occasion on which Mr. Duschamps used his *Serre-Artere*, was in a natural aneurism in one Jean Baptiste Gullimar, a hackney coachman in Paris, who, on the 14th of April 1792, was laid in one of the beds of La Charité, he was of about thirty-four years of age, of a strong and vigorous constitution, it was about the end of September that he first observed, without being able to assign any cause for it, a small tumor growing in the ham ; its increase was rapid, in the seventh month it was as big as an ostrich egg, the pulsation was not visible to the eye, he felt a stiffness in the ham, and a numbness in the whole limb which was otherwise sound.

In making his incision in the fore part of the thigh, Mr. Duschamps very properly applied no tourniquet, being desirous of having the arteries in full pulsation that he might be aware of any danger. He had two small hooks, or flat handles of smooth white-iron with which his assistants held open the lips of the wound ; but he did not dissect the artery clean, he seems to have left the sheath of the artery entire, and to have struck his needle through it. He took a large sharp aneurismal needle with an eye near the point, and pushed it through under the artery ; but the first appearance of the point of the needle was attended with a gush of blood so sudden, as to alarm the assistants, who immediately concluded that the artery was wounded, the colour of the blood, however, and the manner in which it flowed, soon demonstrated that the hæmorrhagy proceeded from his having transfixed the crural vein.

The great needle now lay under the artery, Duschamps laid the point of his finger over the artery, and found that he could compress it betwixt his finger and the needle, so as to suppress the pulse in the aneurism which even subsided somewhat in size while the artery was thus compressed. He therefore put the ligature through the eye of the needle, drew it back, and so laid his ligature double under the artery. “ I chose,” says Mr. Duschamps, “ to lay this ligature exactly under the middle of that part of the artery which was naked, that I might have room, if

occasion should require it, to tie another ligature above *." Now, it is this very precaution that is the ruin of all these operations. He took absolutely great pains to insulate the artery. "The ligature now put round the artery was next," (says Mr. Duschamps), "held up like a bridle by one of the assistants, and pulled pretty strongly, by which I had an opportunity of disengaging it from the surrounding cellular substance above the ligature, which I did with the handle of my scalpel, and having thus freed the artery, I found it easy to pass the needle again, and as I withdrew it I laid an occasional ligature under the artery about half an inch above the first. Each of these ligatures was double, it was only the lower thread of the lowest ligature that was tied, of course there lay under the artery three relays of ligatures which could be of no use (unless the first gave way), and which could not be quite harmless; besides, he laid under the first ligature, a piece of agaric upon the artery, and was forced to pull his first ligature so firm before the pulse ceased in the artery, that his assistant was afraid lest the artery should be cut across."

Such are the operations usually performed upon the femoral artery with every appearance of ingenuity and mechanical firmness, but with no attention to the state of living parts, to that process of inflammation and adhesion by which alone the artery is to be secured after these ligatures fall away. But this operation seems to have been wanting, even in that mechanical security, for the same evening, and no more than seven hours after the straitening of the ligature, Mr. Duschamps thought he felt a pulsation, and he was not deceived. In truth, the ligature had never done its office, the limb had never lost its heat nor feeling, and the pulsation which he had perceived in the evening of the operation was very distinct the next day, "yet I did not," says Mr. Duschamps, "apprehend this to be unfavourable; I expected from the flightiness of the pulsation, that there might pass along the main artery, just a sufficiency of blood for nourishing the limb, while there might be at the same time such a degree of pressure upon it, as to enlarge the inosculating arteries slowly." He resolved not to alarm himself. He left matters in this state for four days, but on the fourth morning he thought he could perceive the pulsation more sensibly, wherefore he resolved to draw the knot upon the lower circle of the occasional ligature. He was

* Page 306.

fearful of renewing the same degree of force which he had found it necessary to use in tying the first ligature upon the artery, and hesitated for some time whether to draw the common knot upon the ligature, or to draw the ligature through the slits of his instrument, his Serre-Artere. He found his ligatures embarrassed, he was obliged to cut the knot and use it only as a help to draw a new tape under the artery. This new tape was laid, the Serre-Artere was set upon the artery, with a piece of agaric betwixt it and the ligature, and the moment it was tied, the pulsation of the tumor ceased, the patient felt a deep and painful shooting in the whole limb, the foot was somewhat cold, though never insensible, and next morning the natural heat was restored, though the shooting continued for three or four days after this new ligature was applied.

But from the moment of placing this instrument upon the artery, Mr. Dufchamps was as unhappy as if he had been conscious of all the fatal consequences of thus infulating the artery. "From day to day," says Mr. Dufchamps, "I was in perpetual fear of the artery bursting" (*attendant de jour a l'autre le rupture de l'artere*). How could it fail to do so? there was still another occasionally ligature lying festering under the artery, above the place where this machine and its ribbon were applied.

Mr. Dufchamps had the prudence to keep every thing in readiness against any accident. The patient held incessantly a compress in his hand, ready to press upon the artery when it should burst. Mr. Dufchamps knew too well from experience what was to happen. Two pupils watched alternately by the patient, and dressings, tapes, and another Serre-Artere were kept in readiness. On the ninth day, in the morning, Mr. Dufchamps was informed that his patient, Gullimar, was loosing blood, "I went instantly (says Dufchamps), though the second ligature, *d'attente*, which lay higher than that, which had just given way, kept me easy. The patient having instantly applied the compress I had given him, had lost little blood, and having every thing in order, I had but to wash the parts clean, get out the ends of this second ligature, and draw them through the slits in the button of the machine. This ligature was tied, a piece of agaric being first interposed, the ligature was drawn, the pulsation ceased, the blood stopped, and no accident happened from this time to the end of the cure. On the seventeenth day after, this ligature came away, and nine days after that, the patient left the hospital cured. The tumor," says Mr. Dufchamps, "is disappearing, the man now follows his old profession

safely, and we can observe one of the collaterals enlarging daily, and trace it easily by its pulsation along the side of the tumor *."

The dangers of these operations seemed to have touched M. Duschamps in a proper manner, and he adds a sentence which deserves notice. "But to speak honestly, this is a subject in which we have yet much to learn; our practice is still undecided, and without principle †."

It is for your sake, and that of humanity, that I criticise thus freely the practice of the greatest surgeons, who are really masters in their profession, and err only in particular points, or where the art itself is imperfect. The history of their operations, thus critically rehearsed, must be interesting to you, and must make you feel all the importance of the subject. You must take a lively interest in the condition of a patient who lies for ten days exposed to repeated hæmorrhages, the slightest of which, if he be already much reduced, may prove fatal. Each case, and each new method of tying the artery brings along with it proofs of the imperfect state of this piece of surgery. You are now qualified to distinguish the faults of each operation. You see that there is a perpetual deviation from the simplest principles of pathology, and must be convinced that every process which insulates the artery exposes it to the danger of ulceration. You will perceive that it is the regular process of this ulceration that determines the bursting of the artery, which, as M. Duschamps himself observes, happens usually on the 10th or 12th day. You will also perceive, that when such operations do succeed, it is only because the successive ligatures had destroyed the intercepted and insulated part of the artery, while

* DRAWING OF THE ARTERY AS IT LAY IN THIS OPERATION OF MR. DUSCHAMPS, DEMONSTRATING THE DANGER OF EVERY SUCH OPERATION.



“ † Mais si l'on est de bonne foi on conviendra que nous n'avons encore à ce sujet aucune connoissance bien determine.”

the last ligature, that which holds the artery and saves the patient's life, is applied close to the sound parts : Above all, you will be sensible that no operation can be more dangerous, more unsuccessful than these, since they do not even satisfy the inventors *.

In my first book on Wounds I proposed that parallel which both explains to us the imperfection of our present operations, and the method which we ought to pursue in order to secure the artery of an aneurismal limb : " What, then, can be the difference betwixt this tying of the femoral artery in aneurism, that it should be so full of uncertainty and imminent danger, and the tying of the same artery in amputation, where the surgeon thinks the death of one patient by hæmorrhagy a flagrant disgrace † ?" The difference is merely, that in the operation of aneurism, the artery is held insulated and extended, and exposed to ulceration ! while in the stump, after amputation, the artery being cut across, is allowed to shrink, and bury itself among the surrounding flesh, with which in due time it adheres, and is obliterated ; and it is only by cutting the artery across in aneurism, and suffering it to bury itself among the surrounding parts, that it can be made equally secure with the artery in an amputated stump. This, which I formerly observed to be the oldest practice ‡, I am now to prove to you is the best ; and the most instructive proof I can give you, after having explained the principles, is to relate from one of those old authors a successful case.

* The observation of Mr. Home, with which, in the year 1793, he insulted other surgeons, is not less aptly applied to Mr. Hunter's operations than to those which were practised before his time. The observation is couched in the following terms : " Experience has shown that *modes* hitherto practised are exceedingly precarious, *being* rarely attended with success, and the death of the patient *being* commonly a consequence of a failure of the operation ; a circumstance which has led some surgeons of great eminence to prefer the amputation of the limb in all such cases."

† On the Nature and Cure of Wounds, page 89.

‡ " I suspect it to be also a point of the very first importance to have the wounded artery sooner buried in granulations and in sound flesh ; for though the healing of an artery depends always in part upon its own lively disposition to inflame and adhere, yet it must depend also in some degree on the support of surrounding parts. Bleeding from a tied artery seldom comes on till the 4th or 5th day ; and if we could here, as in other great operations, lay the skin down and make it adhere before the 6th, or before the 12th, or even before the 26th day (as my late observations explain to you), we should have it all sound before the bleeding came on ; but the surface is often large, the suppuration bad, the artery lies exposed, and may be dilated, or it may be even eroded by the foul pus. Birch says, it was where the great artery of the thigh seemed to have ulcerated, that his injection ran out. Home seems to attribute the death of his friend's patients to great suppuration formed round the bed of the artery ; and certain it is, that Hunter

The celebrated Roman surgeon Joannes Trullius performed this operation in the following manner, related by Severinus, in his book *De Medicina et Chirurgia Efficaci*. "A young man of seventeen years of age was wounded with a ball in the left thigh, about eight inches above the groin. The ball entered betwixt the rectus and gracilis muscles on the fore part of the thigh, and passed out behind through the triceps. This wound was accompanied with a great laceration of parts, especially of the femoral artery, and with a profuse discharge of blood. Trullius, the celebrated surgeon and lithotomist, being called, found the wound already dressed by a barber. He left it untouched till next day, when, upon removing the bandages, he found the parts exceedingly swelled, and the tumor beating so as to raise the hand very powerfully when laid upon it. Trullius suspected a wound of the great artery, a case altogether full of trouble and danger. He begged the friends to associate with him some skilful surgeon, and named Domferante, who, when he came, was as well as himself very fearful of the case."

"Refrigerants and astringents were recommended; the patient was enjoined perfect quietness; and although occasionally the blood burst out to the amount

succeeded better, when in some other cases he closed up the thigh immediately with stitches; for in one case he procured almost an immediate adhesion of the wound, and in a few weeks a perfect cure. Paree, Guy de Chauliac, and all the older surgeons, knew well the importance of surrounding and supporting an artery, and burying it quickly under the granulations. The Arabians, in their operations for aneurism, first tied their ligatures, and then cut the artery across, so that either end of the artery shrunk (surrounded by its own ligature) among the sound flesh, and was no more seen. But, independently of all authority, the reason of the thing instructs us not to keep our wounded artery, as some choose to do, open, that they may see it and tie it when it bursts out, but to bury it so among the rising flesh that it may never be seen, and that in a few days it may be safe from bursting."—*On the Nature and Cure of Wounds*.

That Wiseman, along with the older surgeons in England, were inclined to follow this method, is proved by the following passages. "The cure of an aneurisma consists in the timely application of proper medicaments, and bandage to restrain the blood and keep it within its channel; or by escharotics or the actual cautery you may destroy it. But if it lie where you may take it up, the cure is then best performed by dividing it."

"A poor fellow living in the country was accidentally, in letting blood, pricked in an artery. The arm swelling and growing painful, he put himself into another barber-chirurgian's hands, who, by unfit applications, rarified the tumor, and made way to the extravasation of the blood, which increasing the tumor, and rendering it soft, was supposed by the barber to be a suppuration of matter. He accordingly opened it by knife or lancet, at which an impetuous flux of blood burst forth, to the quantity of four flaggons (as they told me). They made a shift to stop it; but the bandage being made too hard and unequal, the arm swelled, and inclined to gangrene. While this poor man lay thus afflicted, we his Majesty's and Royal

of three or four ounces, it stopped spontaneously. The wound was left untouched for several days; but when at last the bandages were undone, the pulsation, pain, fever, and swelling, were all increased. The pulsation was particularly alarming; others were called into consultation; among so many there was naturally a variety of opinions, but the greater part advised "that this case should be left to time and nature." What could time or nature do but mature the aneurism, disorder the limb, bring the tumor on to bursting, and so endanger the life? Trullius alone was of a very different opinion; he advised that the tumor should be opened, with the design of seeking for the wounded artery.

His sensible advice was overruled; the dressings and rollers were applied anew; but on the 17th day, the blood bursting out again, Marcus Aurelius Severinus was called; and the consultation being met, all the history of the case was recited. The bandages were undone; they found the tumor free from inflammation, the pulsation less, and even the actual bulk of the aneurism diminished, as was affirmed, not only by the gentlemen met in consultation, but by all the attendants, and especially by the barber Hyeronimus, who was always present at the dressings, ready (with burning irons I suppose) to stop the blood.

Highness's surgeons attending the court visited him, and prepared for the taking up this artery, or in case of failure, to cut off his arm. The patient being taken out of his bed, and placed in a chair towards the light, we took off the dressings, and I viewed the arm; where finding no gangrene, according to the report of the surgeon, but rather an ecchymosis, we made a bandage above the wound, to prohibit the influx of blood. One of the surgeons making a gripé thereon, we made an incision into the tumor, on the inside of his arm, according to the length of it over the artery; and after we had pulled out the coagulated blood, and laid the vessel bare, we passed a needle with a ligature under the artery, and tied it, then cut off the ends of it, and loosened the bandage above; and seeing it bleed no more, we dressed it up with pledgits dipt in the common digestive *ex terebinth. cum vitell. ovi*, applying them with *pulv. Galeni* next the artery, and lightly filled up the wound with pledgits of the digestive dipt in *ol. ros. warm*; then embrocated the arm with some of the same oil, and laid a diachalcit. plaster over the wound and parts about; also applied empl. Paracelsi and diachalcit. over the hand and arm, which were œdematous. Then with bandage we began at the hand, and rolled up to the wound, taking a turn or two over it, and so rolled up the axilla. He being returned again to his bed, we placed his hand upon his breast, and felt his pulse beat strongly in that wrist. At the next dressing we found the tumor dispersed, the wound fresh, and tolerably digested. We then passed another ligature upon the artery above the first; and in pulling the first to divide the artery between the ligatures, the artery broke, which was as well. We dressed it up as before we had done, only leaving out the powders. At the next opening, finding the wound in a very good condition, the lips of it being digested and contracted, we dressed it up with *mundif. Paracelsi, &c.* Then seeing it in a hopeful way of cure, I returned to London, leaving the patient to my fellows, who dressed it successfully the space of ten days, without any appearance of blood.

"This fact being decisively proved, it was universally agreed that it would be imprudent to make any change in a line of conduct which seemed so successful. The same methods were pursued, only that attendants were appointed to watch perpetually, and that the patient was allowed more wine."

Thus did matters go on quietly till the 30th day, when the blood burst out again after the old manner, and again stopped of its own accord. The tumor was found suppurating, and suppuration being attended necessarily with the generation of flesh, it was still hoped that the artery would be healed, as it often happens. But we were deceived, says Severinus, for his strength daily declined, his body wasted, and his face was become hypocratic. We began to despair; nor had we, indeed, any chance of saving his life, but by dilating the wound, and either tying or burning the artery."

"The father of the young man was now called in among us, the dangerous situation of his son was honestly explained to him, and we submitted to him the sad alternative of a doubtful operation or certain death. The uncertainty of our very operation we were forced to acknowledge, since it was neither safe in the moment of execution (for some blood must be inevitably lost), nor even certain in its future success. He turned away from us sorrowful, and granting his consent only by his silence.

"The femoral artery was felt for in the groin; the tourniquet was applied; then the place of the incision was marked with ink. Trullius made the incision, and extracted fully six pounds of coagulated blood. This blood led towards the artery. The artery, thus exposed, was separated from its vein and nerve, and tied in two places, above and below the wounded part, and with the same precautions that are usual in tying varicose veins. The artery was divided by the ball more than one half across; the remaining half of the artery was cut across next day by Trullius, "lest it should contract before it putrified;" ("ne forsan partem antequam putresceret contraheret.") Perhaps I do no more than justice to Trul-

In some of their absence the barber-chirurgeon dressed the patient. Whether it was in wiping off the knot, or crowding in dressings, but it burst out again; yet the artery being divided, it soon stopped by the application of colcothar; and from that time it bled no more. The ancient way of deligation is, as I have already said, *by tying it in two distinct places, and cutting the artery off between*; but the patient's often fainting interrupted us in that work. And truly in this case, where a barber was to be intrusted with the cure, it had been better that the artery had not been divided, for then it would not have been in his power to have rubbed off the ligature, and before the wound could have been ready to cicatrize, the ligature would have fallen off of itself, without danger of bleeding."

lius in translating him in the following words: "The artery being thus divided by the ball, not merely through one half, but through two-thirds of its diameter, I next day cut it across, lest it should *ulcerate* before it *closed**; ne antequam putresceret quam contraheret. If this was his meaning, he understood the doctrine as well as the practice; at all events, we have here a good precedent for what I have proposed, it is not the authority of Trullius nor Severinus that satisfies me, it is the fact thus distinctly related that gives a sort of assurance that this method will be generally successful. In all those cases which I have hitherto detailed, in proportion to the surgeon's ingenuity has been the patient's danger! in those cases where many ligatures have been used, where the artery has been made mechanically! firm, it has given way. In all the cases formerly mentioned the artery has burst out several times, and the patient was saved by a sort of accident; in this case alone, wherein the artery was thus simply tied and cut across, it continued perfectly secure. To those old authorities in favour of this practice, let me add that of my friend Mr. Abernethy, who has recommended this method, and who notwithstanding Mr. Blicke's ill success, continues still to recommend it, being supported against the impression of one unfortunate case, by a sensible and serious conviction of the principles upon which this improvement is founded †.

RECAPITULATION.

We are now come to that period of this discourse in which you should begin to inquire what you have learnt, and I should, on my part, recapitulate those conclusions which have the most direct relation to practice.

1st, You must be satisfied, then, that an artery may be actually burst by violence, and yet form its aneurisms very slowly, even the largest arteries of the body after they are burst, are supported in some degree by that firm sheath of cellular substance which makes a part as it were of every artery.

2d, You must have observed that it is this strong sheath that forms the coat of each aneurism; and you may with some degree of truth use this contradiction of terms, "that every diffused aneurism is encysted." The cyst of each aneu-

* "Arteria non erat ad dimidiam partem lacera, veruntamen ad tertiam, una dumtaxat remanente quæ postera die a ligatura-referta est a D. Joanne Trullio ne forsan partem antequam putresceret contraheret."

† *Vide Interesting Essays on Various Parts of Surgery, No. III. by Mr. Abernethy of St. Bartholomew's Hospital.*

rism is formed of the sheath of the artery, supported by the surrounding cellular substance which is condensed often into a bag so firm, and so connected with the artery, that aneurism from wounds, and more especially aneurism from bursting of the arterial coats, may resemble a natural aneurism, and its sac be mistaken, especially in coarse dissections, for a dilatation of the artery itself.

3d, You will see that it is in consequence of this kind of support that the greatest arteries of the body, the femoral artery, the popliteal artery, and even the aorta itself, form their aneurisms so very slowly. You will observe the sac all on one side covering and pressing upon the artery, which shows it to be not a natural, uniform, and general dilatation of all the arterial coats, but a partial yielding of the artery; and when you recollect how easily an artery may be injured, when you observe also that the strain of the muscles which tears the great Achillis tendon, cannot but have very dangerous effects on an artery, you will be attentive to symptoms of which others would think lightly; you will be able to trace the affection to its true cause, and be aware of its nature early; you will foresee the dangerous consequences of delay, and be prepared both to give a decisive opinion, and to adopt active measures proportioned to the real dangers of the case. You know how dangerous it is to consider pulsation as the inseparable sign of aneurism, how entirely the pulsation ceases in the latter stage of the disease, and you know that of all tumors, aneurism is most destructive to the bones, joints, and surrounding soft parts, and should, least of all, be allowed to grow to any dangerous size.

4th, You must be sensible, that while aneurism increases in size, it gradually oppresses the main artery of the limb more and more; the anastomoses enlarge, and the change of circulation which we attribute solely to our operations, is in a great degree the work of nature. The limb on which we operate for aneurism can never be endangered by want of blood; all the dangers of the operation arise rather from the intense action of the lesser arteries of the limb; this is the reason why a large incision falls into gangrene; such a state of the limb is equivalent to the high inflammation of a fractured limb, and it is hence that the stump, (when we perform amputation) runs into gangrene.

5th, You are well aware of the danger of performing any operation in the ham itself. The cavity is narrow, the parts compressed, the bones and joint easily affected, the artery not easily found. If you seek the artery there, your incision must be large, and a large incision, combined with the turgid state of the

limb, will bring on high inflammation, followed by gangrene. The incision must be deep, and as the inosculating arteries cannot escape, if in your operation you cut but a few of them, you will have a secondary hæmorrhagy from channels which you cannot command ! if you cut many of those inosculations which at the moment of your tying the main artery should support the limb, it may fall into direct gangrene from a total want of blood, not preceded by increased heat and inflammation of the wound, but by coldness in the lower part of the limb.

6th, You know that all that is required towards completing the natural process, and turning the tide of blood upon the inosculating arteries, is to tie the main artery, and that by performing this operation on the fore part of the limb, you cut no inosculations, you expose no bones, and you have no difficulty in finding the artery. You have no temptation to strike in your needles clumsily, nor to put your ligatures coarsely about arteries, veins, nerves, and all ! so as to make the ligatures loosen from the parts very slowly. You have it in your power to dissect the artery clean, to cut up the sheath in which it is enclosed, and separate it distinctly and deliberately from the vein and nerve.

7th, You are well aware, that after all that has been said of gangrene, few have died of it ! that many have died of hæmorrhagy from the bursting of the artery ! that this bursting of the artery proceeds from ulceration of it, which is the reason why it bursts usually about the tenth or twelfth day. You must be satisfied that every mechanical contrivance for securing the artery insulates it ; that every artery by being insulated and held off from uniting with the parts which should support it must ulcerate ; that Mr. Hunter's operation upon the sound part of the artery, is not more secure than that which was before his time performed in the seat of the disease, in the cavity of the ham itself. You will, I doubt not, assent to that conclusion which I have deduced from innumerable facts, " That the more of mechanical ingenuity appears in any operation of this kind, the farther has the operator departed from the true principles of surgery." That the surrounding of an artery with four ligatures, with split quills, with plates of lead, with pieces of bend leather, with compress of agaric, cork, &c. are as inconsistent with the process of nature as the sewing of an intestine round and round with a double row of stitches.

8th, The right way of securing a great artery, is perhaps one of the most important points in speculative or practical surgery ! To tie the artery at two places, to cut it across to let the ends retire among the surrounding flesh, to let it

shrink entirely out of sight, to allow it thus a fair chance of connecting itself again with the other parts, and of suppurating, adhering, healing along with them, is probably the only way of giving the artery, which is tied in aneurism, all the security of an artery tied on the face of a stump in amputation.

Now, Gentlemen, I have done my duty. I have drawn out in this aphoristical form, a few of those conclusions which are to serve you as principles in this branch of surgery, and while I have been employed in proving those principles, I have been careful to lay before you a full view of the subject. Far from shrinking from the task of criticism, I have been careful to select for you examples of good and of bad practice; I have made you familiar with all the interesting and difficult questions in pathology; I have taught you to reason upon each individual case; I have, as it were,—brought you to the bedside of your patient, and made you more than mere spectators in these scenes of distress.

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DISCOURSE IX.

ON WOUNDS OF THE ARTERIES; OF THE ANEURISM WHICH FORMS OVER THE WOUNDED ARTERY; WITH GENERAL INSTRUCTIONS AND RULES OF CONDUCT FOR THE OPERATIONS ON GREAT ANEURISMS.

SECTION I. OF OPERATING ON GREAT ANEURISMS.

I HAVE been hitherto employed in explaining to you the complicated anatomy of aneurisms, the value of inosculating arteries, and the condition of an aneurismal limb. I have taught you how to consult, but as yet I have not taught you how to operate. The description which I have given will enable you to reason on the nature of the disease, but other descriptions are necessary before I can teach you how to operate in actual wounds of the arteries.

I will now explain to you the nature of that tumor which rises over a wounded artery, not where the artery is cut across at the bottom of a wide and open wound, for there it throws out its blood unrestrained, and either it is presently tied or the patient bleeds to death; but where a great artery is wounded deep among the muscular flesh, where it is punctured, for instance, with a knife, bayonet, or sword, or cut by a bullet, or splinter of shot. The blood escapes with difficulty through the narrow wound, there is little outward bleeding, the artery bleeds chiefly within! and by that inward bleeding, a tumor is suddenly formed of the most dangerous nature, requiring almost as sudden an operation as if the wound were open and the vessel quite exposed and pouring out its blood. The artery indeed is still open, it is pouring out its blood among the internal parts, and nothing resists it but the skin! if that slender barrier gives way, the patient dies with one gush of blood.

OF THE MANNER IN WHICH THE OUTWARD WOUND IS HEALED, AND THE ANEURISM FORMED.

When a man is wounded in any great artery, the blood flows in so full a stream, that in a moment he faints, and it is then only that the by-standers can

command the blood (by gathering up any cloths that are at hand, and cramming them into the wound in a confused and ineffectual way), till at last the surgeon comes and stops it altogether. Now, the surgeon at the first sight of such a wound is himself alarmed, he fears that it is the great artery of the limb; he is unwilling to lay open the arm or thigh, and to undertake the tying up of the great artery without some farther help and advice; he throws off the loose cloths or bandages; lays a firm compress fairly upon the wound; rolls it with a steady bandage, and leaving a tourniquet about the limb, informs the friends of his fears, and of all the expected difficulties and dangers of the case, and desires that some consulting surgeons may be called. The consultation proceeds at first upon these points, the place of the limb that is wounded; the shape of the weapon; the deepness of the wound; but the consulting surgeons do not in general unbind the wound (at least if it be a deep and pointed wound), till the skin has adhered, till the aneurismal tumor is formed, when being enabled to undo the dressings without any danger of farther bleeding, they have all the case before them.

The tumor rises higher and higher every day; at every visit they see a change. The tumor is large, hard, circumscribed, and beats very strongly; the skin over it begins to inflame, the wound of the knife threatens to open again, the whole limb is feeble and cold; the surface of the tumor is livid, and in a few days the beating from such an artery, as the femoral artery, is most alarming, and to the patient very awful; he lays his hand upon the tumor, and feels it beating, like the heart in its strongest palpitations. He is laid with tourniquets round the limb; he perceives by these precautions, and he feels sensibly, that should the tumor burst during the night, he must lose his life with one gush of blood. Lying in this anxious condition, he is watched continually till the hour appointed for the operation arrives; and it is then only (however great the surgeon's fears about this operation), that the patient is in any degree safe.

It is not always that the surgeon has his mind so made up to the tying of these great arteries, as to perform his operation at the first visit; and yet he may as well do so! for whether he, by reasoning, convince himself that it is safe, or apprehend it to be dangerous to tie the great artery of the limb, still the circumstances of the wound are the same, the artery itself (whether it be the great artery or a branch, whether it be only punctured or cut across), is lost to that limb; the tying of it is no sacrifice, and as to the aneurism it is uncontrollable. Aneurism never stops; the wounded artery cannot heal; the blood spreads every

day wider and wider among the cellular substance, the parts are disordered, the bones corrupted, the skin at last is ready to give way, and nothing can save the patient but an operation; the surgeon has, indeed, the privilege of delaying his operation for a week or a fortnight, but not without infinite danger to the patient in the mean time, and a more difficult operation, and more extensive disease in the end.

These considerations should determine the surgeon how to act in this critical moment. When called in good time to such a wound, he should clap the point of his finger upon the wounded artery, or make his assistant hold it while he lays open the wound more freely, obtains a distinct view of the artery, and draws it out from among the cellular substance if it be cut across, or if it be only punctured passes his ligatures under it with the needle, the eyed silver probe, or any instrument that is most at hand. Thus may he prevent the aneurism, the extravasation of blood, and the destruction of the parts.

But in nine of ten cases, the surgeon wants the courage to do this (which he thinks a hopeless operation) upon the spot. He is anxious to have the support and countenance of others of the profession, he is afraid of a wounded artery, and shrinks from one of the most natural operations in surgery; for, even a man uninstructed in our profession, would instinctively try to stop a bleeding artery. The case accordingly falls to be decided by slow and hesitating consultations. The surgeons debate, Whether it be the trunk of the artery that is wounded? Whether if it be the trunk it should be tied? Whether the inosculating arteries are sufficient for the circulation of the limb? Whether the limb should not rather be cut off? and those important questions, those general axioms of surgery, which every surgeon should have studied thoroughly, are debated upon in the moment of consulting on an actual wound! Thus it happens that the outward wound is compressed, the outward bleeding prevented, the blood no longer escaping outwardly, but extravasated within the fascia, removes the artery from the external wound, and this wound being walled up on its internal surface with clots, is allowed to heal! then the skin and fascia adhere, the inward bleeding still goes on, and the regular aneurismal bag is formed.

Perhaps there are certain circumstances, in which it is even our duty to bring the case into this shape; for example, if there be a wound of the great arteries in the back of the hip, in the groin, in the armpit, we cannot command the blood easily; we are not sure of clapping our finger down upon the artery, at the

very point where it is wounded; we are afraid lest the patient should die (even after we have come to him), with one single gush of blood; we therefore close the narrow wound, put its lips together, settle it with a very steady compress and bandage, and try to make the lips adhere, and then we have a fair aneurism, which we can look upon composedly; we can reflect upon the course of the wound, and calculate which artery is most probably wounded; for besides the main trunk there are other arteries in the armpit and the thigh, as the arteries of the scapula or the *arteria profunda*, which, when wounded, will form aneurisms as large, though not so dangerous as those of the axillary or femoral arteries, and to be distinguished from them chiefly by the continuance of the pulsations in the wrist or ankle.

CONCLUSION.—You have had the whole of the facts which relate to the value of inosculating arteries, displayed before you, you know that these arteries are sufficient for any purpose in all parts of the body, you know that it is not necessary that the tide of the circulation should be gradually turned into them, but that we are perfectly successful, though they have not been slowly enlarged. You are assured that these arteries are sufficient to save the limb, and can have no difficulty in attributing the gangrene, which sometimes happens in the last stage of aneurisms (or which follows operations), rather to inflammation than to want of blood. You will hold it as an established rule of surgery, that a great artery when wounded, must be tied; and in those cases even where you cannot find the artery, when you dare not seek for it, when you have not the necessary instruments nor assistants for tying the artery, when the patient is reduced too low for you to venture upon any operation, when you dare not in the slightest degree open up the wound; even in these circumstances though you dare not immediately attempt to secure the artery, you will take the earliest opportunity of securing it, and will prepare for performing your operation as soon as the patient has recovered from the first loss of blood.

OF THE ANEURISMAL SAC.

The arterial trunks and all their greater branches in every part of the body lie under the fascia; and seem to owe no less to the support of the fascia, than the muscles themselves. Over the whole body the fascia is almost equally strong; the skin and fascia, when the wound of an artery is closed with compresses, are pressed together and adhere; the blood, by this accident, is always driven hard under

the fascia, and is never diffused under the skin; the skin merely covers the aneurismal tumor; while it is the tense fascia that gives form to the aneurism, and constitutes its sac. The fascia, thus confining the blood, limits the size of the tumor, gives it a fair and circular form, is itself tense and firm, livid also by the colour of the contained blood, and shining like the inner surface of the gizzard of a fowl. The skin and fascia may be cut distinctly from each other, as freely, as we cut the skin above a diseased breast without touching the hardened gland, as we draw our knife along the surface of a hernia, without touching the sac, or as we cut the skin above the hydrocele without touching the vaginal coat.

Nor is the surface of an aneurismal bag very irregular, even upon its back part, for each muscle is involved in its own fascia, so that the fascia is also of tolerable strength within; the internal processes of the fascia, viz. those which enclose the individual muscles, thicken when compressed by the effused blood and the condensation of the cellular substance, as it is driven closer by the blood, sets some bounds to the extravasation within. Thus the blood is no more diffused among the flesh than under the skin; the blood coagulates in all the extreme parts of this circle of extravasation, and by being kneaded as it were into the cellular substance, gives a peculiar firmness to the tumor.

The fascia, then, makes the great covering of every aneurism, but the strength and consistence of the sac, and the succession of parts, must vary infinitely according to the nature of the wound. If the aneurism be in the thigh, and be formed by a fracture of the thigh bone, instead of being formed only under the general fascia of the thigh, it will extend under all the muscles; and in that case the cellular substance which connects the muscles with the periosteum, and those divisions of the general fascia which connect the several muscles with each other will form the sac. The vastus externus, vastus internus, and the rectus cruris, will lie extended over the whole sac; the general fascia of the thigh (extended in its turn over the muscles) will thicken, and form an outward capsule, as it were, including the whole tumor, muscles and all; and over that will be the skin quite moveable, and disjoined from the fascia by cellular substance, except in those parts of the surface near where the wound is, and where of course the skin is fixed by inflammation.

But if the femoral artery be wounded with a ball or knife, either cut entirely, or almost entirely across, this will be the condition of the parts. The skin and fascia

will be united, the skin and fascia will form the two coats of the tumor, the blood will be widely diffused both before and behind the wounded artery, and the cellular substance which surrounds the artery being undermined by the blood, the artery itself will lie at the bottom of the aneurism wholly insulated.

If the aneurism be formed by a small puncture on the fore part only of the artery, it may happen that the blood will not separate the artery from the surrounding parts; the general fascia of the thigh will form the aneurismal sac, the blood will lie altogether on the fore part of the artery, and the artery itself will lie imbedded among the muscles, almost concealed by the inflammation and thickening of the cellular substance, none but the wounded part appearing.

When the aneurism is in the bend of the arm, the artery lies superficial, is covered only with the fascia and skin, and the fascia makes the sac of the aneurism. The fascia is at this place peculiarly thick and strong, it resists very powerfully, the aneurism is not that diffused tumor that is generally imagined, it is as fairly circumscribed as any sacculated tumor; and so elastic is the fascia, and so much are the parts straitened within, that the moment the incision is made through the skin the aneurism protrudes, the skin retires on each side, and the sac appears as fairly circumscribed as if the incision had been made over a hernia or a hydrocele.

CONCLUSION.—Thus the succession of parts regulates the several steps of our operation. Our first incision penetrates the skin and cellular substance only, and unless the aneurism be on the point of bursting, this incision never touches the sac, but is carried lightly through the skin over the tumor, so that the skin retires on each side, and the tumor protrudes. Our second incision is made through the sac, the tumor protrudes, and the transparent fascia which forms the sac allows the blood to be seen through it. The tumor is of a purple colour, shining and tense; the lancet is struck into the top of this tumor, the blood begins to roll over the edges of the incision, or to be thrown out in great clots; the surgeon introduces his finger, and runs his knife upwards and downwards along the whole length of the tumor. To use a scoop for the blood is absurd; it is very like the formality of a systematic writer to commend such an instrument, but it is very unlike a practical or dexterous surgeon to use it, or even to lay it among his instruments. He turns out the clots with his fingers, and then sees the artery lying flat at the bottom of the tumor. The succession of parts is very regular, yet, since the form of the aneurism is various, since no dissection of the sound parts, no description of aneurism, can give a perfect idea of the relation of parts to each other, let the surgeon

be prepared for difficulty and confusion; let him prepare himself for encountering such difficulties, by considering the duration and progress of the disease, and the manner in which the artery was wounded. Let him try to imagine how the parts will lie with regard to each other, whether the aneurism be under the fascia only, or under the muscles, whether the parts be separated from each other, or massed together by inflammation, and by the blood driven in among the cellular substance.

Thus the advantages to be derived from an aneurismal bag being formed over a wounded artery, either before we are called, or by our own compresses forcing the wound to heal, are these. That we are not hurried, all at once and unprepared, into the midst of a bloody operation; that we are somewhat easy about our patient's immediate safety, there being no danger of immediate bleeding, at least for a few days; that we have timely warning of every danger, by the changes on the surface of the tumor, which turns livid, inflames, and gangrenes, before it bursts. The wound suppurates, opens, and discharges a thin serum, before the actual blood bursts out, whence we have time to consult, to calculate which artery is wounded, and to settle all the steps of our operation as deliberately as on any ordinary occasion.

OF THE CONDITION OF THE SURFACES OF THE ANEURISMAL SAC.

But it is equally plain, that though a recent aneurism is thus managed with more ease to the surgeon, and less loss of blood to the patient, than a large and open wound; yet an old aneurism, suffered to grow for weeks or months, is attended with greater danger. For if the artery be very great, as in the hip or thigh, the bag enlarges very rapidly, all the parts are compressed and hurt, the blood is driven deeper and deeper among the muscular flesh, and at the same time that the soft parts are disordered, even the bone may be spoiled, which must render the operation ineffectual in saving the limb. The same accumulation of blood that makes it more difficult to find the artery, presses it deeper every moment, and farther out of the reach of the surgeon; the sac, in an aneurism of the thigh, becomes, in a few weeks, capable of holding six or seven pounds of blood, and this extension of surface is the cause of profuse suppuration, which (wherever the matter is, as in this case, contaminated with blood), is never kindly.

Two things conduce to throw the whole of these surfaces into a very unfavour-

able condition: First, The skin is so extended that its vessels are compressed, it is deprived almost entirely of circulation, and becomes livid, like a strangled part; at last it falls into actual gangrene; and such is the morbid condition of the external surface, that frequently the parts are hardly to be distinguished from each other; the skin, fascia, and coagulated blood, are all one pulpy mass. We have no reason for sparing such skin, it cannot recover its healthy state, and in those cases where the aneurism has been thus extended to bursting, it has been often necessary to cut part of it away. Among the old surgeons, as Saviard, Severinus, and Ruisch, we find, that the operation for aneurism was so much dreaded, that it was never voluntarily performed; aneurism was often at the point of bursting before the surgeon would put his hand to it; he operated only in extremis, with no other design than to save the patient from immediate death; and this is the reason why those old surgeons very generally began their operation with a crucial incision, and finished by cutting off, with great scissars, the four flaps or corners of the skin.

While the surface of the tumor is thus passing through the various stages of suffocation and gangrene, the parts within are not in a much happier state for recovering. The pressure is mutual, the internal surfaces are compressed, while the outward surface is extending, and the blood is so driven in amongst the cellular substance that it is choked with the extravasation; the smaller vessels of the internal surface are suffocated, and the blood suppurates out from among the cellular substance very slowly, and with a very foul discharge, whence the whole inward surface of an aneurism often sloughs like a gun-shot wound. This is perhaps the cause sometimes of secondary hæmorrhagy, arising from the ulceration of the smaller arteries, and the universal bad condition of the surface. The older surgeons provided for this. They cauterized the sac of an aneurism with red hot irons, because of its being a surface which must necessarily slough; and they dressed the basin of the fore, like that formed by a cannon-ball, with hot turpentine, and powders composed of nitre, myrrh, and other antiseptic gums.

CONCLUSION.—Though it is not our practice (nor is it necessary even in the largest aneurisms) to make crucial incisions, to cut away the flaps, to extirpate the sac, or to cauterize the surface, by which the ancients thought to dry up the putridity, and promote the sloughing; yet this gangrenous condition of the wound is never to be overlooked; and the filling of such a sac with lint covered with powders of myrrh and bark, or of stimulating it occasionally with turpen-

tine dressings, or a spirituous balsam, is peculiarly proper. And since we foresee this sloughing state of the sore, and are aware that the blood which remains is apt to hurt the disposition of the wound, we should perform no part of the operation more carefully than that of cleansing the sac. Instead of merely clearing away the great clots of blood, so as to see the wounded artery, we should wash and sponge it with particular care, fill it slightly with caddis or scraped lint, and compress it moderately with a general bandage.

OF THE CONDITION IN WHICH WE FIND THE ARTERY.

There are but two conditions in which the artery is found, and from the state of the artery conclusions of some importance may be deduced. I have reason to believe, that in almost all aneurisms, the artery lies quite insulated. The blood passes along the sheath of the artery, and diffuses itself among the cellular substance with which the sheath and the artery are both surrounded. Thus the blood penetrates easily behind the artery, whence the artery lies along in the cavity of the aneurismal sac, surrounded with blood; you may slip a probe under it, you may almost put your finger round it, you may sometimes lay hold of it with your finger and thumb, and pass your ligatures almost without the help of any instrument. "The muscles," says Severinus, "are so separated from one another, that the blood which separates them being hooked out, the artery is found at once, as if it had been dissected*." The ease with which the artery is found, has been represented as no small advantage, and from this has been deduced a very dangerous conclusion, viz. that the longer the operation is delayed, the more easily is it performed!

But it sometimes happens, that the blood lies only on the fore part of the artery, that the blood has not been driven deep among the cellular substance which surrounds the artery, that the blood and general tumor press the artery down against the surface of the muscles; the cellular substance surrounding the artery is thickened, the muscles are inflamed, the artery is attached to the parts which form the back part of the sac, it is nitched in among the muscles, and is not to be distinguished but by the jet of blood, and by the orifice alone appearing.

I remember an operation in which the femoral artery presented itself in this

* Secundum quod ita musculos sanguis ab invicem divulserat ut eadem grumoso extracto statim obvia nobis fuit arteria, ac si arte musculi separati fuissent qui operandi commoditatem miram præbuerunt.

condition, and was found and tied with great difficulty. The tourniquet gave way, the blood was flowing out with great impetuosity, the operator was timid; instead of expecting to stop the blood only by flitting up the tumor rapidly, he expected to check it, by closing the sac, and by pressing down the lips of the small incision which he had just made. The scene of confusion during this moment was indescribable; but he saw that the man's life was in jeopardy, and he at last resolved to slit up the tumor; he did so, and I clapped the point of my fore-finger upon the slit in the artery, which lay firmly imbedded among the muscles. There had been such manifest danger and alarming loss of blood, that the surgeon now resolved to come at his object the nearest way; he would not consent to dissect round my finger, and clear the artery of the surrounding parts; but taking a large needle, he struck it very deep under the artery, through among the muscular flesh; and the ligature was so exceedingly thick, that it required the assistant-surgeon to pull with all his force before he could compress the artery. The moment I lifted my finger, the blood came from below with almost the same force that it had flowed from above; a second ligature, equally clumsy, was struck under the artery a little lower, and then the hæmorrhagy was perfectly suppressed, the sac was cleaned, and the patient laid in bed. This hurried operation, these coarse ligatures, and the deep stroke of the needle, though they saved the man from immediate loss of blood, actually endangered his life. The anterior crural nerve, and much muscular flesh, were enclosed in the coarse string that was used, and on the eighth or tenth day the artery ulcerated; it burst out during the night, and the patient was in great danger; the bleeding was prevented by firm compression, and thrusting down a sponge upon the artery.

CONCLUSION.—Never delay your operation, that the inosculations may in the progress of the disease have time to enlarge; for the most sudden operations have been the most successful. Never wait for the diffusion of the blood, that it may insulate the artery, and make it be more easily found; when such a rule is proposed in the following direct terms, I believe it will appear in all its absurdity; “Would you wait till the blood injected among the cellular substance, separated those parts which you ought to dissect?” This delay occasions an extension of the sac, and a bad condition of the fore, and endangers secondary hæmorrhagy, from erosion of the inosculating vessels.

Never be in a hurry in tying the artery; for as soon as you see the wound of it, and have got hold of the vessel, the danger is over. Do not allow yourself to strike

your needle coarsely through among the surrounding parts, nor tie in the muscles nor nerve; for the muscles fade, so that the ligature relaxes, and the nerves remain unaffected by the ligature, and continue to hold it fast, till the artery, after having united, happily inflames, ulcerates, and bursts out anew. This direction, then, of clearing the artery, relates neither to the muscles nor to the nerves, for the tying the crural nerve can do it not the smallest harm; so clumsy an operation is dangerous only to the artery which is tied in along with it.

OF THE DIFFICULTY OF COMPRESSING THE GREAT ARTERIES AT THE AXILLA OR GROIN.

In performing our operations on the great arteries of the arm-pit or groin, we must trust nothing to assistants, nothing to compression of the artery; we must do our operation with peculiar boldness and skill, otherwise we shall hardly save our patient, for in a single moment he is either safe or dead.

Camper was the first who imagined, that the axillary artery might be compressed above the place where the tourniquet can be applied. He demonstrated the fact; he put the pipe of a syringe into the right subclavian artery; he threw water along the arteries, and allowed it to flow out, by opening the left axillary artery. He then applied his thumb upon that artery, *below* the clavicle, and found, that by a moderate pressure he could resist the stroke of the syringe, and prevent the water flowing out. Mr. Blizzard was the next who spoke of this observation as of importance, especially to the military surgeon. Perhaps there could not be a more patriotic and sensible thing, than to give a lesson on the application and use of the tourniquet to the cadets of the Artillery School; and in a discourse on this subject, we find Mr. Blizzard giving a slight sketch, by Cipriani, of the manner of applying the compress, and of fixing it by pressing with the thumb *above* the clavicle. The expectation excited by so natural a proposal, so well supported by anatomy and by experiment, if not by experience, was very great. It was very natural to suppose, that it must be equally easy to compress the femoral artery at the groin; at last it came to be universally believed, that the surgeon had no reason to be afraid; that if he failed to suppress any hæmorrhagy it must be for want of skill; that the fixing of the thumb over the artery at the clavicle or groin, was as effectual as the application of the tourniquet itself. What good or harm may have been done by this invention, it were presumption in me to say; but this much it is my duty to mention to you, that this method of com-

pression is insecure ; that it will be apt to fail you in your greatest need ; that the living circulation, and the struggling of a man under the tortures of an operation, is very different from the experiment made by Camper, with an anatomical syringe on a dead body.

I will also tell you what I have actually seen. In an aneurism of the axilla, the surgeon trusting to the compression which his assistant made above the clavicle, opened the tumor, was deluged with blood, and saved the patient only by striking a great needle under the artery ! he saved his patient for the moment, but could not save his life ; he died of hæmorrhagy in a few days.

A friend of mine appointed myself and another surgeon to compress the artery of the groin, while he performed the operation for femoral aneurism. Our cushion was well made ; our pressure upon the artery in making the experiment beforehand stopped at once the pulse in the foot and the throbbing of the aneurism ; we pressed much more firmly during the operation. I fixed the compress with all my force ; the other gentleman lay over me, and supported my thumbs with his ! We had every reason to believe that we had a perfect command of the artery ; yet at the very first stroke of the knife, the surgeon, having cut into the aneurism, was covered with blood, and saved his patient with difficulty.

Mr. Allanson was called to a man who had been blown out at the port-hole of a ship by his gun going off while he was ramming home the charge, and found the arm so shattered, that he was forced to amputate at the shoulder joint. In performing this operation, he found that the compression of the subclavian artery, even in a man who was lying quite stupid from the violence of the explosion, had not the slightest effect upon the artery ; for having begun his incision on the part the most distant from the axilla, on the outside of the arm, he found the smallest branches bleeding profusely, and his expression is remarkable, “ after which an arterial branch discharged so freely, that we were convinced the pressure on the subclavian artery was not effectually, though judiciously made *.”

CONCLUSION.—I will repeat with confidence what I have formerly affirmed, “ That it is one thing to suppress the pulse in the lower part of the limb, and another thing to stop the pulse in the great artery.”—“ I have tried in great operations near the trunk of the body to stop the blood by pressure ; but though I

* Allanson, p. 185.

could suppress the pulse of the femoral artery with my fore-finger, I could not command its blood with the whole strength of my body *."

I beseech you, then, do not deceive yourselves with any such expectation; do not believe that the effect of this pressure is such as to allow you to perform a quiet deliberate operation; look upon this operation as one where you have to deal with an open artery, and lay your account with being covered with blood the moment you open the sac. Nor must you ever expect to clear the great cavity of blood so as to enable you to see the bleeding artery; it will, on the contrary, fill the cavity with blood faster than you can bale it out, till the patient breathes his last. Operate in such cases with that rapidity and decision which can alone ensure your patient's safety; there are occasions in which the old seducing word Caution is full of danger.

* The fact which I have here affirmed is of too much importance for me not to maintain it with more than common earnestness. I affirm then, that "though the throbbing of an aneurism, or the pulse in the lower part of a limb be quite suppressed, yet the circulation is not stopt; and I entreat the young surgeon never to trust to any such mark of the compression being effectual." This I have formerly affirmed, in my Anatomy of the Arteries, and will continue to affirm (as Luther said), "though as many devils as there are tiles in Bath were combined against me." It is because I affirm this, and because I have ventured to doubt, that compressing the carotid arteries will cause sleep, cure convulsions, and restore maniacs! that Dr. Parry of Bath has run out upon me the whole length of his chain. He has abused me in a Magazine, and, if I am rightly informed, has written lately a book on Angina Pectoris, where I am not spared. I have had retention enough not to answer Dr. Parry in his Magazine; yet is he not to suppose, that I will let myself be worried peaceably.

Dr. Parry asks, "Whether the ceasing of the pulse in the lower part of the limb be not a certain mark of the circulation being oppressed," and, "Whether there be any other mark by which the surgeon can know when his tourniquet is effectually applied?" I am confounded at such questions coming from a gentleman of Dr. Parry's rank in his profession. The surgeon always screws the tourniquet till he suppresses the pulse in the lower part of the limb; but he never knows whether he has suppressed the circulation, whether the artery be effectually compressed till he has begun his operation, and then if the arteries of the limb bleed, he screws this tourniquet a little firmer. Once, while I was performing the operation for aneurism in the arm, although the tourniquet was so applied as to suppress both the pulse of the wrist and that of the aneurism, the instant the incision was made the blood flowed in full stream. My assistant screwed and screwed again; he actually undid the tourniquet in the middle of my operation, took it away, and applied another, and then I finished the operation. This happened in a public hospital.

"AM I A DOG THAT YOU ARE COME OUT AGAINST ME TO BEAT ME WITH STAVES."

Dr. Parry has written against me a manifesto of a most extraordinary nature. I should be loth to call it a polemical paper; it is a mere explosion, which, like that of an unskilful engineer, instead of scattering the enemy, or overturning their strong towers, blows his own ranks into the air. "And I do love to see the engineer hoist with his own petard."

This deliberate and careful detail is necessary for your understanding the various difficulties of this case ; but the description is not such as to carry you along with the rapidity and hurry of an actual operation, nor does it leave that impression upon your mind which should prepare you for operating.

THE OPERATION DESCRIBED.

When you are to operate on any great aneurism high in the limb, take all the advantage that compression or the tourniquet can give you ; but do not trust to them ; do not allow yourself to be confounded though the blood rush out upon you ; be prepared to do your operation with an intrepidity which shall make you independent of every assistance. First draw your knife deliberately and fairly over the tumor, so as to lay it open. The skin being thus divided, the great livid bag of the aneurism, surrounded with its strong fascia, rises into view. Next push your lancet into the sac, and then do all that remains in your operation

The compliments which Dr. Parry has paid me are so unequivocal, and of so flattering a kind, that I cannot but recite them. His haste, his violence, his apprehensions concerning the effect of my book on this important doctrine of the Compression of the Carotid Arteries, are no small compliments. He acknowledges that I have quoted Costæus, Valverdi, Hoffman, Morgagni, Drelincurtius, Rufus Ephesius, sensibly, and to good purpose, but that I have not spelt their names correctly ! “ That I have studied them all with great attention,” but still I have not spelt their names correctly ! He acknowledges, that he himself (though writing about the carotid arteries) has never read one word of Realdus Columbus, Rufus Ephesius, nor any other of those authors whose names go rumbling along through his medical manifesto ; but he, at least, spells the names correctly ! He read that story of the She-Goat first in my book ; but he spells the name Drelincurtius much better than I do ! Dr. Parry concludes with accusing me of confounding him “ with the dust and mould of our College library,” which, when one considers the polite society which Dr. Parry frequents, was a most mischievous, malicious contrivance.

But I will at once make all the acknowledgments which Dr. Parry requires. I allow him all the advantages exclusively, of his orthographical discoveries, and never shall correct a proper name in any new edition of my book, without giving his authority on my margin. I believe, upon Dr. Parry's assertion, that he never heard one word of the Mounti-Bank, the She-Goat, the Young Man of Pifa, nor of the Assyrians, except in the Bible, or in Rollin's Ancient History. I declare that I never meant to affiliate the story of the She-Goat of Pifa, and the Hysterical Lady of Bath. I also acquit Dr. Parry of the slightest plagiarism, because I perceive that the Bibliophobia, now too common a disease, is fully as prevalent at Bath as elsewhere ; and in charity to Dr. Parry's disease, viz. this Bibliophobia, unwilling to excite his irritability, or risk another paroxysm of so violent a distemper, I promise to blow no more of this pulvis Olympicus, or rather Gothic dust, upon him. In respect to the names of Realdus Columbus, Rufus Ephesius, and others, I will bind myself to keep the peace, and mention them no more ; for I am sensible,

with great boldness; run your bistoury upwards and downwards so as to slit up the tumor quickly; plunge your hand suddenly down towards the bottom; turn out the great clots of blood with your hand and fingers, till having reached the bottom entirely, you begin to feel the warm jet of blood, and directed by that, clap your finger upon the wounded point of the artery! as it is but a point, your finger will cover it fairly, and your feeling the beating of the artery will assure you that all is safe.

Now the bleeding, confusion and fainting are over in a moment; the operator breathes, and the assistants are composed; and all the operation goes on easily and safely. The artery is effectually commanded by this pressure with the finger; but the first movement in such an operation, viz. the act of stopping the blood,

that if he has had an aversion all his lifetime from the individuals of that party, he must have now a mortal hatred at the whole generation, and all their aiders and abettors. He very ingenuously relates the manner in which he was seized with his first paroxysm; it is indeed pitiful, wondrous pitiful. One unhappy day he stepped into a bookseller's shop in Bath, and there having seen my second volume of Anatomy, returned home in a violent paroxysm; and the recollections of the forenoon's accident working like a poison, he at last began to rave loudly about Realdus Columbus, and Rufus Ephesus, as heretofore the great critic John Dennis raved about one Cator—Cator. Alas! could not Dr. Parry, if he has really any faith in his own doctrine, have sat quietly down and applied his thumbs steadily and skilfully to his carotid arteries?

I would very willingly and heartily congratulate Dr. Parry on his discovery, were it not that discoveries are now showered down upon every blockhead; and the distinction is of such a kind, that, in my opinion, it is hardly Pharisaical to say, I thank God I am not as other men are, a physiologist, a discoverer, or even as this ———. But I grieve for Dr. Parry when I reflect on the probable fate of this doctrine, so different from what he himself imagines. He speaks of it as a discovery for which he will be envied by the whole world, by all generations, present and to come. "Excuse me (says Dr. Parry), excuse me thus dwelling on myself; I am compelled to do so, lest hereafter, when my method of cure (viz. by clapping, not his fore finger, observe now, but his thumbs, upon the carotid arteries!) when my method in those diseases (hysterics, convulsions, headache and mania, and bleedings from the nose!) when my method of cure (viz. *compressing for the hysterics!*) comes into general use, as certainly it will do! some future Mr. Bell, envious of a discovery which chance has allotted to another, shall," &c. No, no, no, I am not envious, and if I were, this is one of the discoveries which I should think it a sin to steal; for I perceive such a theft would break the owner's heart and do the pilferer little good. It is one of those discoveries which will stick to the author. It is now public, it is more secure than that of the Circulation, or of the Lymphatic system, for Harvey and Hunter were in great danger of having their discoveries stolen from them; but Dr. Parry I will venture to ensure for a trifle.

When the celebrated Dr. Hunter mentioned in his class that a certain northern discoverer had discovered and made engravings (which, by the by, are still extant) of nerves in lead, in tin, in finger nails, and in the hairs of his own wig! the Doctor protested in the following terms: "Gentlemen, I have many

of getting at the artery, is all boldness, and nothing of caution; no danger is to be apprehended, but that of suffering your patient to lose blood.

Being now composed, you take time to arrange every thing for the next step of your operation, you feel the beating of the artery with the point of your finger, perhaps you raise the point of your finger for a moment, to discover whether the pressure of your assistants, at the groin or clavicle, commands the artery: If so, you lift your finger, and examine round the artery; if not, you keep your finger steady, make the assistants clean the sac round the artery; then, if the artery lies fair and free in the bottom of the cavity, you proceed to tie it; but if not, you must dissect round the artery, until you see it free from other parts, and have it so insulated that you may put your ligature easily under it, unless, indeed, the recollection of some great trunk being near the wounded artery (as of the profunda, when you are tying the femoral artery), should stop you. But yet

times laid claims to some of this professor's discoveries, but this discovery is so comprehensive, so surprising—! This! I protest, is none of my discoveries, no, no, no."

I will quote no more of Dr. Parry's paper, but refer my reader to the Monthly Magazine for this precious literary morceau; it is a singular specimen of the urbanity and bien-séance of a Bath physician. Living in atmosphere of hysterics, spleen, and hypochondriacism, he takes up the comparison which is most at hand, likens me "to a fine lady pouting, and laughing, and crying in hysteric fits!" calls me anatomist, and many other bad names! and as if to be an anatomist were to be an idiot, he compares me with Jedidiah Buxton of *notorious memory*.

In return, I will tell Dr. Parry a thing which will very much surprise him. I have a sincere respect for him, not on account of his politeness, his moderation, his polemical talents, his orthography, or his learning, but because I am assured by his friends, that he is a worthy and honourable man, highly and justly respected in his profession, and zealous for the improvement of it. I believe him to be a man of excellent abilities, and though in this point I cannot agree with him, I am sorry that I have offended him. Yet I fear that Dr. Parry's own conduct in this affair will hardly please even himself upon reflection. I declare upon my honour, that I should have been happy, had Dr. Parry complained politely, to have torn out any offensive paragraph, but he has attacked me in such a manner! "*fervecit sanguis, et ira scintillant oculi, dicisque facisque, quod ipse non sani esse hominis, non sanus juret orestes,*" when I thought I was but repeating an amusing story known to all the world (except Dr. Parry) about the She-Goat of Pifa, and the Young Men of Assyria, behold Dr. Parry comes thundering and foaming upon me, exclaiming, against what? Why against my intemperance!—Surely Dr. Parry is of the family of the absolutes, and will allow nobody to be in a passion except himself. "Damn you young rascal (says this absolute) can't you be calm like me? can't you be cool Sir, like me, do you ever see me in a passion? none of your grinning jackanapes;" but Dr. Parry should also remember that I may perhaps have a little of the absolute blood in me, and that all who claim of kin to the family of the absolutes have the same license. "Never mind Jack, why its Jack's way and its my way, and its all our ways,—it runs in the blood of the absolutes."

"Excuse me thus dwelling on myself."

the nearness of any great artery or nerve is an argument as strong against your diving with the needle to catch the wounded artery, as against your dissecting with the knife. Since, therefore, the dissection is done with your eyes open, and you can see and feel before the point of your knife, rather dissect, or sometimes tear the artery naked with the point of your fingers, tie its open mouth, if cut across, as fairly as in an amputated stump; or if it be punctured only with the point of a knife or sword, put two ligatures round it, one above and one below the wound, and put them neatly and fairly round the artery, and then cut the artery across betwixt the two.

With respect to the size and form of your ligatures, do not allow in yourself the slavish and absurd fear of cutting arteries across with your threads. It makes surgeons use clumsy ligatures in amputation, often ineffectual; and in aneurisms of the thigh or shoulder, such tapes are used as it would be impossible to draw tight even round the aorta, though that could become the subject of operation; the circle of the knot made by such a ligature is often wider than the diameter of the arterial trunk round which it is tied! Surgeons have complained that they could not draw their tapes tight enough round the femoral artery, even with the whole strength of their hands*.

Let your ligature, then, be made of three or four threads well waxed, tied not with the surgeon's knot, but with one single knot moderately drawn, secured with a second single knot, the threads left hanging from one corner of the wound. It can hardly be necessary to advise, that after such operations upon the femoral artery, tourniquets should be still kept round the limb, to guard against those accidents which have so often happened, and will, we fear, continue to happen, in the hands of the most famous surgeons.

But if it chance that the parts are so massed with inflammation, so disordered by the driving of the blood in old aneurisms, or perhaps so hurt, as to be almost in a state of gangrene; if the surgeon cannot by any means get a fair view of the artery, and that his patient be losing blood, pouring from some great trunk, then he must strike his needle at random, in order to come at his object the nearest way; and the only satisfaction that he can have, or the only proof of his having tied the artery at all, will be the sudden stopping of the blood when he draws

* "Aussi at on vue des occasions ou il n'a pas ete possible de se rendre maitre du sang. Dans un operation d'aneurism de l'artere poplitee, un chirurgien tres exercé aux operations chirurgicales, ne peut parvenir a fermer suffisamment l'artere et l'on fut obligé, d'avoir recouru a l'amputation." DUSCHAMPS.

his ligature. In circumstances like these, the greatest surgeons (even Mr. Pott himself), have been accused of having missed the artery; the artery at all events, in such a case, is irregularly and insecurely tied, the attendants that are appointed must be skilful, and must be interested; both friends and surgeons should watch over the patient's life most faithfully, for successive bleedings will happen sometimes from so slight an accident as a sudden turn, or unwary motion in his bed during the night.

Of one thing I am chiefly afraid, namely, that my description may seem overcharged; that I may appear to have exaggerated the difficulties of an operation like this; that it may be thought that an accident requiring all these precautions, and this plunging down of the hand, can hardly occur. Therefore I submit to your consideration the following case, and I dare say, you will find that it needs no apology; but that as it is new and interesting, it deserves its place.

"A poor man, who was by trade a leech-catcher, fell as he was stepping out of a boat, and the long and pointed scissars which are used in his business being in his pocket, pierced his hip exactly over the place of the sciatic notch, where the great iliac artery comes out from the pelvis. The artery was struck with the point of the scissars, it bled furiously, the patient fainted; and in so narrow and deep a wound, the surgeon, when he came, found little difficulty in stopping it up, and less difficulty still in making it heal. The outward wound was cured; the great tumor soon formed; and the man travelled up from the north country, where the accident had befallen him, and in six weeks after arrived in our hospital here with a prodigious tumor of the hip, his thigh rigidly contracted, the ham bended, the whole leg shrunk, cold and useless, as if it had been an aneurism rather of the artery on the fore part of the thigh.

"The tumor was of a prodigious size, and by that very circumstance of its being one of the greatest aneurisms, it had lost all the characteristics of aneurism. There was no pulsation, no retrocession of the blood when the tumor was pressed upon; there was nothing else peculiar in the tumor except this, that the great and sudden distension occasioned great pain; and from the continual pain, and lameness, and from having some hopes of a cure, he was ready to submit to any thing, beseeching us to operate.

"There was little doubt of this being a great aneurism, but there was a possibility of its being a vast abscess; and it was resolved in consultation that the patient should be carried into the operation room; that a small incision should

be made ; that the skin being cut, the bag itself should be just touched with the point of a lancet ; if found to contain matter, it should be fully opened ; but if blood, then it was to be considered as an aneurism of so particular a kind, as to entitle us to call for a full consultation.

“ I made an incision two inches and a half in length ; the great fascia of the hip appeared blue, and very strong, forming the coat of the tumor, and under that were seen the big fibres of the great glutæus muscle. The knife was struck into it, and large clots of very firm black blood rolled out ; for such was the tensesness of the tumor, that it began to emit the clots in this way, the moment it was punctured. There was one thing further desirable, that before we put the patient to bed, we should understand the case so far as to be able to report to the consultation, whether the artery was absolutely open, and whether it was the great artery of the hip. I continued therefore (knowing that the opening I had made could be covered with the point of the thumb) to pull out a few more clots, till the warm and florid blood began to flow ; I then pushed in a tent-like compress into the small wound of the tumor (viz. of the fascia), laid a broad compress over the outward wound, and put the patient to bed, with one of the pupils holding the hand upon his hip.

“ This was done at one o'clock, and at four the consultation met, and the operation was performed. And in my notes, I find two steps of the operation chiefly marked :—First, That upon our opening the tumor fully with an incision of eight inches long, and turning out the great clots, the blood was thrown out with a whishing noise, and with such impetus, that the assistants were covered with it, and in a moment twenty hands were about the tumor, and the bag was filled with sponges, and cloths of all kinds, which had no better effect than the cloths which, in any accident, the friends in great confusion wrap round a wounded arm ; for though the blood was no longer thrown in a full stream, nor in jets, it was seen rising through the edges of the incision ; it floated by the sides of the cloths, which were pressed down by the hands of the assistants. But we knew also by a more alarming sign that the blood continued to flow, for the man, who was at first lying not flat, but supporting himself on his elbows, fell down, his arms fell lifeless and without pulse over the side of the table, his head hung down, his face was livid, he uttered two or three heavy groans, and we believed him dead.

Secondly, Seeing, in this critical moment, that if he was to be saved, it was to be only by a sudden stroke, I ran the bistory upwards and downwards, and at

once made my incision two foot in length: I thrust my hand down to the bottom of the tumor, turned off the great sponge which was over the artery, felt the warm jet of blood, put the point of my finger upon the mouth of the artery; then I felt distinctly its pulse, and then only was I assured that the man was still alive. The assistants laid aside the edges of this prodigious sac, and fought out the several smaller sponges which had been thrust in, and the sac being deliberately cleaned, and its edges held aside, I kept the fore-finger of my left hand steady upon the artery, passed one of the largest needles round under my fore finger, so as to surround the artery: one of my friends tied the ligature, and then upon lifting the point of my finger, it was distinctly seen, that it was the posterior iliac artery,—that the artery had been cut fairly across, and had bled with open mouth—that it was cut and tied exactly where it turns over the bone: and although the extremities were cold, the face of a leaden colour, and the man had ceased to groan, and lay as dead; though the faint pulsation could not be felt through the skin, in any part of the body; we saw the artery beating so strongly under my finger, that we were assured of our patient's safety; however, he was so low, that after laying down the sides of the sac, and putting bandages round his body to keep all firm, we were obliged to have a bed brought in, and having given him some cordials, we left him to sleep in the great operation room, attended by the pupils and by nurses. He passed his urine and fæces involuntarily for some days, and was long in recovering his voice.

He was cured of this great wound in less than seven months, although his cure was protracted by the foul suppuration of such a sac, and by the exfoliation of the ilium and sacrum, which spoiled, not so much from their having been laid bare by the last sudden stroke of the knife, as by the aneurismal blood having pressed upon them; the exfoliations were very large, and the sacrum especially continued exfoliating to the very day on which the wound closed.

I do not know whether this man have recovered entirely, for he left the house lame, from the contractions of the hip and ham, and walking by the help of a stick; but however, he thought himself fit to undertake his profession, and went to England with that design*.

This case will impress the directions already given upon your mind, it is singu-

* Dr. Farquharson, who succeeded me in the charge of the hospital, has just informed me, of this man having called upon him after his return from England, walking stoutly, and in good health.

lar and worthy of its place, since the aneurism was one of the largest ever known, containing not less than eight pounds of blood. It is also an instance of one of the least probable of all wounds, viz. a small sharp point touching one of the deepest arteries, and one of the largest; and wounding it at the very point, where it comes out from the trunk of the body; and where it cannot be compressed; for though my friend Dr. Farquharson, tried to make some impression upon the descending aorta, by pressing down his fist into the belly, so as almost to touch the spine, still there was a deluge of blood upon cutting up the tumor, and the artery beat strongly under my finger. But if any thing can increase your interest in this case, it must be such an accident as that which I am now going to relate.

—— M'Donald, a very stout young man, by trade a shoemaker, threw himself carelessly down on the lid of a box, where a great nail sticking up, ran into his hip. For one day he concealed the accident which had happened to him, but next day the hip was greatly swelled and very painful; the wound healed, the swelling increased for some time, and was judged to be a deep seated inflammation; and when at last the fluctuation was distinctly felt near the surface, and a little below the scar made by the nail, it was supposed to be the fluctuation of matter. It was in truth the fluctuation of blood! for the surgeon punctured the most prominent and softest part of the tumor, watery blood issued, and was stopped with great difficulty, but at last it was stopped. The integuments were by this time in a very dangerous condition, inclined to slough and give way; the original wound actually burst open, and, as well as the lancet wound, discharged blood; both wounds were now secured with compresses and a firm plaster of rosin.

It was in this dangerous moment that my friend Dr. Jeffrey was called to visit this patient. The wound was precisely opposite to the glutæal artery, at the place where it issues from the pelvis. The tumor extended but a little way above the point where the nail had run into the hip, but it was of considerable breadth, and it descended along the buttock so as to occupy the upper and back part of the thigh. From the extent of the tumor, the blood which it discharged upon being opened, and the difficulty of stemming the torrent of blood, there could be little doubt of the nail having run into the glutæal artery.

And now ensued that agitating and turbulent scene which is occasioned by the officiousness of friends. The surgeon was absurdly blamed, as if it were possible

for a lancet to reach the glutæal artery through all the thickness of the glutæal muscles. This aneurism must have been of vast extent at the time of the surgeon touching it with the lancet, it distended chiefly the lower part of the hip and top of the thigh, removing the integuments, as Dr. Jeffrey very naturally observes, at least to the distance of six or eight inches from the place where the great vessels lie in the sciatic notch. These idle reflections, which no surgeon could have given any countenance to, entirely occupied the minds of the friends in this moment of dissatisfaction; Dr. Jeffrey's opinion was rejected, and other Gentlemen were called into consultation. Dr. Jeffrey's opinion was at last assented to, and the relations of the patient began to repent of the harsh expressions they had used. They now consented to have the tumor laid open and the artery sought for, but while matters were preparing for this important operation, the young man having occasion to go to stool, rose from his bed during the night, the wounds burst open, and in a few moments he expired.

DISSECTION.—An injection-pipe was put into the iliaca communis within the pelvis, and the femoral artery was tied under Paupart's ligament. The whole basin of the aneurism was laid open by a long incision, the coagulated blood carefully removed, and tepid water thrown into the artery. The jet of water was seen to issue from a vessel that seemed to stand out with a trumpet-like mouth, from under the haunch bone near the sciatic notch. Here then a phenomenon presents itself, which the surgeon in operating upon such an aneurism should not forget, for he might tie what only appeared to be the arterial mouth! This was not the mouth of the artery, it was a clot of very firm blood, which, coagulating among the cellular substance which surrounds the artery, projected much beyond the mouth of it, and might have deceived the surgeon.

This firm coagulum, which represented the mouth of the artery, being brushed off, it was found that the wound of the artery had in truth nothing of this appearance; the artery was not cut entirely across as in Stewart's case where it was wounded with scissars, but was merely punctured with the point of the nail; the artery was the great glutæal or posterior iliac, it was wounded within half an inch of the sciatic notch, and the hole was round.

“ The friends (says Dr. Jeffrey) who saw the immense quantity of coagulated blood which lay betwixt this wounded artery and the skin, were satisfied of the innocence of the surgeon, a man of unquestionable skill in his profession. The medical gentlemen were satisfied, that had the real nature of the accident been

discovered in time ; had the relations agreed when the opinions of the medical gentlemen were reconciled ; had they consented to the operation when it was proposed ; had they not obliged me to lose the favourable moment in demonstrating blood-vessel preparations to them, and explaining the nature of the accident ! the life of this young man might perhaps have been saved, for betwixt the verge of the sciatic notch and the wound of the artery, there was abundance of room for striking the needle under the wounded part."

RULES OF PRACTICE.

After these descriptions, a few rules should be sufficient, yet I will venture to repeat such points as I think may be of particular service.

1st, In great aneurisms of the arm or thigh, when the tourniquet can be applied, do your operation deliberately, steadily, slowly, but do not needlessly prolong your patient's suffering. Cut the skin nicely, open the sac freely, dissect your artery very clean, if it be massed along with the other parts by adhesion ; and tie it clear of the nerve, and pass your ligature with a blunt needle or crooked probe ; for whenever you are reduced to the necessity of using the sharp needles, your patient is in danger. Tie your artery with moderate firmness, tie it in two places (for on several occasions the retrograde blood has flowed out even in the time of the operation), clean the sac, look now attentively to your two ligatures, and if you see the upper one moving according to the pulsation of the artery, all is right. Finally, if you approve of my reasoning, cut the artery across in the middle betwixt the ligatures.

2d, When the tourniquet cannot be applied, trust nothing to the compression at the axilla or groin, for though it is sometimes effectual it often fails, and lives have been endangered by a surgeon's entering on such operations without being prepared for the worst. You find by making the experiment on your own arm that you can stop the pulse ; you think yourself able to secure the patient, but it is, I protest, a mere deception, for the circulation is not suppressed when the pulse ceases, or the pulsation of the tumor prevented.

3d, While I counsel you to trust nothing to compression, I still advise you to take every assistance ; let your assistant try to compress the artery, but do not lay your account with performing a cool deliberate operation, expect rather a dash of blood at the first stroke you make into the sac, and confusion and alarm

of every kind. Compose your mind for such a scene, bend up each corporal agent to this attempt; expect safety for your patient from nothing but your own daring operation; be resolute, bold, and rapid, but let this boldness be the result of serious deliberation, and earnest consultation with your friends. And in what does this rapidity consist? Is it a dangerous stroke that you are to make? No surely! the rapid movement is merely flitting up suddenly the half putrid and tendinous sac, and turning out the clots of blood with your fingers, while the artery, nerve, and all the important parts lie safe at the bottom of the tumor. You are to trust much to your acquaintance with the parts, therefore make sure of your knowledge of the artery that is actually wounded; return to your books, drawings, and preparations; hold consultations with your friends; lose no opportunity of making up your mind beforehand; the more you reason upon the case, and revolve the possible dangers, the greater will be your prospect of sustaining yourself with becoming resolution in the moment of operation.

4th, Do not piddle at this operation as if it were some ordinary business, nor look timorously into the sac, soaking up with cloths and sponges that blood which you should not allow to flow; hiding the danger in this way, is but increasing it. Meet the danger like a bold and well instructed surgeon, do not be afraid to see the mouth of a wounded femoral artery, look your enemy in the face! cut the skin as slowly as you will, but slit up the sac rapidly, spread it wide, look down to the bottom, be directed by feeling the warm blood upon your finger, or by seeing the jet of florid blood! for the moment you see the artery all danger is over*.

5th, When in great wounds, as of the axilla or groin, or when in bursting aneurisms, the hæmorrhagy has been profuse, and the patient is faint and low, and almost dead; do not hasten, as a vulgar person would do, with heat or cordials, to revive your patient from that fainting which has saved many lives! Never rouse the circulation till you are sure you can command the artery.

If I have been guilty of some repetitions I hope they are useful repetitions. They are designed not for your amusement but for your instruction. As a teacher I venture to give you one admonition, which I am sure you will take in good part; think of the momentous operation which I am describing, and let that

* The first word in this paragraph requires an apology, it is a mean and homely expression; I might indeed save myself from trivial criticism, but I should do my reader an injustice were I to substitute for it the best sounding word in our language.

be my apology for pressing upon you this piece of advice. Do not neglect the study of anatomy ; but make yourself perfect in it before you enter upon any important part of your profession, and especially before you meddle with aneurisms, where the patient's life is in such manifest danger ! before you enter into the military service, where much the greater number of those who perish in the field die from wounds of the great arteries ! before you begin to perform great operations in surgery, where hæmorrhagy is the chief cause of confusion, and the unnecessary wounding of arteries the greatest error. Our old surgeon, Turner, after very awkwardly comparing the searching for an artery and tying it, with the seeking out a piece of cord from a bundle and tying it with two smaller threads, concludes his discourse in the following terms : " Excuse me, Gentlemen, you know doubtless what I mean by this rude simile, that the UNDERTAKER OUGHT TO BE A DEXTEROUS KNIVES-MAN OR ANATOMIST, both Myotomist and Angiotomist, not only expert in muscular dissection, but in the situation or course of the great blood vessels also, the study and practice whereof I so earnestly pressed upon you in my last section, so that I shall shut this perhaps overlengthened one with the same advice."

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of the part. The first word in this paragraph respects an artery, it is a mean and homely expression, I might
indeed have used more elegant terms, but I should do my reader an injustice were I to substitute for it
the plain language which is the language of the surgeon.

DISCOURSE X.

OF THE OBLIQUE WOUNDS OF ARTERIES.

PERHAPS I might be justified in saying, that the wounds of the arteries are more important in proportion as the artery is small. But of this I am well assured, that where you are not forced to operate by the great size and manifest danger of the aneurism, there is much steadiness and good sense required in resolving upon an operation, which to an ignorant man seems almost unnecessary! And there is more merit in dissecting and tying a small artery which lies buried under muscles, cellular substance, and coagulated blood, than in finding the femoral artery at the bottom of an aneurism formed by a large and regular sac.

When an artery like that of the hip or thigh is wounded, it forms an uncontrollable aneurism. Such an artery drives every thing before it, forms a large sac, distends more and more till it is in danger of bursting, and if allowed to burst proves fatal.

But when smaller arteries like those of the fore arm or leg are wounded under the bellies of the muscles, the aneurism is more irregular, the operation very difficult, and the dangers quite of another kind. The blood is injected slowly among the cellular substance and under the muscles; no sac is formed; the blood is not collected but diffused; the pulsation is slight or there is none; the limb is swelled and hard, the skin black as in a mortification, the blood bursts out from time to time. It is considered only as a hæmorrhagy, while it is in truth a diffused aneurism; the patient, by repeated loss of blood, is reduced to extreme weakness, and the limb gorged with blood, and with its parts so insulated and disjoined from each other, by the extravasation, often falls into gangrene. These are the usual consequences of such a wound! if the patient escape it is after long continued suppurations, foul sinuses, and a great destruction of the limb.

There are also certain parts of the body where the smallest arteries produce the same consequences. The axilla, for example, is a very large cavity filled with the

loosest cellular substance, fit for lodging the vessels and glands. The external thoracic or pectoral artery, which if it lay along the wrist or the temple, and were wounded there, could not do the smallest harm, is capable of forcing the cellular substance of the axilla; it has as much effect on the loose cellular substance of the axilla, as the femoral artery has on the firm cellular substance of the thigh; it has often filled the axilla completely with blood, forming a very large and dangerous aneurism.

These subjects I propose now to explain to you, and shall add a few rules for suppressing the bleeding from open wounds where the arteries lie quite exposed. The radial, ulnar, and tibial arteries, in the lower parts of the limbs lie so superficial, that their bleedings ought to be easily suppressed; awkward and imperfect operations are disastrous only from the successive hæmorrhages, and not from the important size of these arteries.

The point of practice which I have first of all to represent to you, is the difficulty of finding an artery when it is wounded obliquely by the slanting stab of a knife or sword, or by the oblique course of a ball. This difficulty is greater than it will be easy for you to imagine; I shall speak the more fully upon this subject, in order to explain to you the nature of these difficulties, and to convince you of the natural dangers of such a case; but I wish to impress strongly upon your minds the still greater dangers of ignorance, or timidity; the folly of making incisions too small for the occasion, which, notwithstanding, are such as to produce all the pain of the greatest incision, without accomplishing the purpose for which they were designed.

What case is more dangerous, or what operation more important than this which we perform upon a wounded artery? and where is the other great operation, in which our first incisions are done in this timorous way? I should, I am sure, think myself much better entitled to cut up the axilla, to get at a wounded artery, than to cut through the perineum and bladder, to extract a stone. The one indeed is the more terrible disease, but the other, as you will see by the following example, is a business of immediate life or death.

Before I enter upon the description of a case which I mean to state to you, I feel the necessity of explaining what I think is the import of the case; and, in a few words, the matter is this:—Sometimes, an artery being struck with the point of a knife or sword, is merely punctured, and not cut across. The obliquity of such a wound, acts like a valve upon the artery, there is but little blood

poured out under the skin, and no remarkable tumor is formed: Now the surgeon satisfied from the sudden and violent gush of blood, that an artery is opened, feels himself called upon to look for the bleeding vessel, and to lay open the arm or thigh; but presuming too far upon his own knowledge of the arteries, he makes a new incision along the course of the artery, *neglecting the more easy and obvious way of seeking for the wound in the artery, by enlarging the natural wound.* When, for example, the artery being wounded from the outside, he ventures to seek for it by a new incision from within! He gets to that side of the artery, where no wound is; his attempts to make it bleed, only press the slit-like wound of the artery so much the more firmly down against the flesh below! He cannot see the wound, nor even believe that there is one; he tries to make it bleed, but he fails; still, he sees the main trunk of the artery lying in the bottom of the wound, beating strongly under his finger, apparently entire, and he cannot yet believe that there is any wound in it. He continues his work, but can by no contrivance force the artery to bleed; he can never see where the wound in the great trunk is, nor be satisfied whether or not the blood flows from some smaller artery; but no sooner does he leave his patient than it bursts out furiously, and bleeds from time to time, till the patient expires. If I can produce one such case, it will be at once a lesson and warning to you; and the warning will be the more impressive, in proportion to the respectable rank of the surgeon, who may have been guilty of such a mistake.

A young man of 25 years of age, in parrying a blow, aimed with a sharp pointed knife, at his breast, received it in the middle of his arm. The knife, entered at the outer edge of the biceps, and touched the Brachial Artery; he staggered forwards a few paces, and then, fainting with the loss of blood, fell down. Unfortunately there was no one present but a young pupil in surgery, so ignorant that he bled him in the other arm, and tied up the wounded one, merely laying a compress upon the wound.

Till the 8th day, there was no farther alarm, when a very slight cough brought on a violent bleeding, then fortunately, a surgeon was called, who really understood the dangerous nature of the case, and he, in his turn, called Mr. Duschamps, upon whom the care of the patient devolved; he found the arm enormously swelled, from the armpit to the elbow, and covered with ecchymosis down to the wrist.

“ At nine in the morning, says Mr. Duschamps, I began the operation, the

patient being seated, and every thing prepared. But behold, when I introduced my probe into the wound, it passed so far upwards towards the axilla, that I feared the wound was very high, perhaps in the Axillary Artery itself; so that instead of the operation for aneurism, I might find myself obliged to amputate at the shoulder joint. I begged to have another surgeon joined in consultation, and accordingly Mr. Sabbatier met me in the evening at five o'clock. The operation was performed in the following manner :"

Mr. Duschamps made an incision, not by enlarging the natural wound, but by a new cut along the inside of the arm, in the tract of the humeral artery, full six inches long, extending downwards from the tendon of the pectoral muscle along the arm; and by this incision, he penetrated into the aneurismal bag, and cleansed it thoroughly of coagulated blood. Mr. Duschamps and his assistants then suspending the compression under the clavicle, hoped to see the wound, or at least to be directed to it by the bleeding; but though they examined and wrought a full quarter of an hour, and although they saw and felt the main trunk of the artery beating under their fingers, they could not by any endeavours make it discharge one drop of blood; so that one of them ventured to say, he thought it could not be the main artery that was wounded; while others agreed, that nothing but a wound of the main artery could account for the first loss of blood.

In this state of uncertainty, it was resolved to lay an occasional ligature under the artery, which at any time might be used, if necessary, while the artery itself should be subdued by compression alone with agaric and dry lint *. Mr. Duschamps, first, enlarged a little the wound of the knife, and introduced his finger

* He is confused to the last degree in his account of the case, so that one cannot guess, whether he did or did not strike this occasional ligature through the skin and flesh, as the older surgeons did; as Mr. O'Halloran was accustomed to do on difficult occasions, or as Mr. White did lately in Captain Mounsey's case. But what makes one suspect that he did so is this, that he makes the following contrast of the two parts of his operation: We resolved, says Mr. Duschamps, to use on the *inside* of the *wound*, a compression extending along the course of the artery; but beforehand, to put in an occasional ligature, " Dans cette incertitude, nous resolvumes d'employer dans l'interieur de la plaie une compression sur le trajet de l'artere, et prealablement de placer une ligature d'attente." And next, he says, " I passed this ligature half an inch above the place, to which the point of my finger reached within the wound;" by which it is plain, that he passed this ligature either through the skin, or through the wound he had made on the inside of the arm, and not through the wound made with the knife, which he had now dilated no further than to admit his finger, and he introduced his finger for no other purpose than to serve as a director. " Je pris le parti de choisir ce lieu pour celui de la ligature, que je fis cinq à six lignes au-dessus de l'endroit ou repondoit l'extremite de mon doigt."

into it, pushing it upwards towards the axilla ; and by this dissection, he applied his occasional ligature half an inch higher than the point of his finger.

Secondly, He covered all the course of the artery, within the wound, with agaric and lint, secured by an eighteen tailed bandage ; but so slightly bound that it did not suppress the pulse.

At four in the morning the blood burst out, but it stopped again of its own accord ; it burst out twice the next day, and in like manner stopped again. On the third day it burst out yet again ; but the hæmorrhage which came on upon the fourth morning was frightful indeed ; the bed was soaked through and through with blood, which, from the foulness of the dressings, had contracted a horrible smell. At ten in the morning I reached my patient, says Mr. Duschamps, and undid the bandages. The agaric and lint were left in the incisions which I had made with the knife ; the lint was drawn out of the original wound ; there was now no bleeding, and the patient was dressed as before ; but again at mid-day the blood burst out with amazing force, and again it was stopped by the attending pupil. Mr. Duschamps now undid the dressings entirely, and cleaned the parts, hoping to see the wound of the artery, or at least the jet of blood, but not one drop flowed. “ With a patient so exhausted,” says Mr. Duschamps, “ I durst no longer trust to compression ; I now resolved to draw the occasional ligature, and the instant that it was drawn the blood was thrown out with force, proving very plainly that this ligature was below the place of the wound. I applied instantly a second ligature above the first, the blood was immediately stopped, and as immediately did the patient lose every degree of heat and of feeling in the limb.” At this last operation of Mr. Duschamps, his patient had lost about three porringers of blood ; half an hour after he fainted ; in a few minutes he revived a little, but a storm passing over head at this critical moment with some loud peals of thunder, affected him so much, that on the third hour after the operation he expired.

“ Upon opening the body,” says Duschamps, “ we found the brachial artery wounded from the outside and from behind ; the wound was above the giving off of the profunda humeri, small, punctured, made with the point of the knife just under the border of the great pectoral muscle ; the occasional ligature surrounded the artery immediately below the wound, and that ligature which had suppressed the bleeding was half an inch above.”

These are all the circumstances of the case faithfully translated : But the ma-

nifold mistakes, though some of them are sufficiently obvious, are yet upon the whole so complicated one with another, and are at the same time so important, that I feel it my duty to explain them to you.

Was it not a weakness to suppose this same *arteria profunda* to be absolutely essential to the preserving of the limb? And yet this is an opinion which Mr. Duschamps declares in the most unequivocal terms. "Certain other means might perhaps have assisted me in securing the artery in this case; although after all," says Mr. Duschamps, "the wound of the artery being above the going off of the profunda, it was in vain to think of saving the arm; but still if such means had but secured the artery, and saved the patient's strength entire, we should have had in reserve the amputation at the shoulder as our last resource *."

Was it not as great a weakness to think of succeeding by compresses, without the compression's being sufficiently firm to obliterate the artery? Mr. Duschamps applied his compress and bandages so slackly, that they never affected the pulse; but had he conceived the true notion of obliterating the artery, and bound his compresses so as to have suppressed the pulse, the artery must instantly have been forced to bleed, and he would thus have discovered at his first dressing what he discovered too late, and only when he drew the occasional ligature, I mean the place of the wound.

Was it not a conceited and forward thing to trust thus to his knowledge of the artery, and try to find it out by a new incision, when he might have been conducted exactly to the wounded point by the plain direction of that wound through which the knife had touched the artery? By this wilfulness, Mr. Duschamps looked upon the artery on the wrong side; he saw it only through his own incision upon the inside of the arm, while it had been wounded by a stab which reached it through the upper and outer edge of the biceps muscle, i. e. from without. In short, when the man had been wounded from the outside of the arm, his surgeon looked for the wound from within, and the consequence was most natural, viz. that he felt the whole trunk of the artery beating strongly under his finger, yet could procure no bleeding from it, and could not see the wound. This case satisfies us of a fact, which is proved also by other accidents (as the aneurism

* "Ce procédé m'auroit été de la plus grande utilité dans la première observation. La blessure de l'artère, à la vérité, étoit au dessus des artères profondes supérieures, et par conséquent trop haute pour espérer de conserver le bras; mais le malade alors n'étant pas épuisé, il restoit la ressource de l'amputation dans l'article."

from bleeding), that an artery wounded with a small and slit-like wound, though fairly cut, will yet preserve its pulse, and will not bleed.

But when Mr. Duschamps found that his incision was too short, and that his operation was imperfectly done, or not at all, when he found his patient bleeding thus dangerously, why did he not exert himself? Why did he allow his patient to endure five successive bleedings without even undoing the dressings, when he ought absolutely to have laid open the arm? Surely I may say that he should have laid it open, when he himself says, that he had almost intended to cut it off.

His incision was made from the border of the pectoral muscle down along half the arm, and into the aneurifmal sac. Now, his finger had been passed into the stab which the knife had made, and had not by a great way gone down into the bottom of that wound; his ligature was placed no more than half an inch beyond the point of his finger, but still it was below the opening of the artery, as was proved during life by the repeated bleedings, and after death by dissection. Why then did he not go forward with his knife? Why, when he knew the wound to be oblique, when he suspected it to be high, when he thought it was even in the axillary artery, why did he not go forward into the axilla? Why should he have stopped at the border of the pectoral muscle? Or what is this pectoral muscle that it should be respected more than the other muscles of the body?

But, in the relation of this case, the last bold stroke, the only successful one, is the most melancholy thing of all. It explains but too well what ought to have been done at first, and how successful it would have been if it had been done in good time; for he at last cut open the arm, tied the artery fairly, and so prevented any further loss of blood.

This idle incision on the wrong side of the arm, on the side opposite to the wounded point of the artery; the long searching, without being able to see the artery, or to force out one drop of blood; the absurd thought of suppressing this bleeding by compression, while the pulse at the wrist remained entire; and the frequent bleedings and the final issue of the case; and most of all, the sudden falling down of the arm senseless and motionless the moment that the great ligature was drawn, including of course the artery, vein, and nerves, are the most decided marks of a bad operation, ill concerted and ill performed, and are lessons so important, as to make it a duty to criticise in these rude terms men even of the highest name; and therefore it is that I choose thus to do my duty, and to bear the blame.

But even in this matter of delicacy, I mean to do something more, both to impress this lesson, and to exculpate myself. I will not leave it for any one to say, "This, after all, may be but one mistake of Mr. Duschamps, counterbalanced by many bold and well concerted operations." It is not so; and I proceed to prove, that if, as I think, he was wrong, he was habitually wrong; that these things were not done merely through the hurry and confusion of such a case, but that this way of cutting for the wounded artery at the wrong side of the limb, was his customary and settled practice.

A young man, a joiner by trade, twenty-one years of age, wounded himself with a chisel in the thigh, with a wound slanting from without inwards and backwards; the wound was about two-thirds down the thigh; the blood flowed with great force, and the young man was carried to the great Hospital, la Charité, in Paris, where Mr. Duschamps was first surgeon*. The next day, says Mr. Duschamps, at seven in the morning, I examined the thigh, found it slightly swelled, lifted the dressings, and as soon as I lifted that piece of lint which lay immediately upon the wound, the blood jetted out in a full arch, and the place of the stab, and the quantity of blood, left no doubt as to its being a wound of the femoral artery, nor any question about the proper operation, which therefore was deferred no longer than till eleven o'clock."

In presence of Mr. Chopart, Boyer, and others, I then began the operation, by passing a probe into the wound, and the direction of the wound, which it was not easy to pursue, carried the probe towards the femoral artery, and, as nearly as I could guess, towards that point where the artery passes through the triceps muscle.

"Without minding this wound at all, I made a new one of five inches long in the tract of the femoral artery, so directed as that the wound of the artery itself should most probably lie in the middle of this long cut. The integuments being thus opened, I dissected through that muscle which immediately covered the artery, with all possible care, till I distinctly felt the artery beating under my finger. As there was no extravasation of blood, and of course no cavity, it was impossible to lay the artery quite bare; but yet I cut it up, as closely as common prudence would allow of; the artery wounded from behind, presented no wound

* "Au tiers inférieur antérieur de la cuisse droite, avec un ciseau dit bédane, dont le tranchant étoit de dix lignes. Cet instrument pénétra de *devant* en *arrière*, et de *dehors* en *dedans*, et ouvrit l'artère femorale."

to me on this side, and though we suspended the compression at the groin, not one drop of blood flowed, neither from my incision, nor from the wound: Once more, I introduced the probe into the wound of the chisel, and felt the end of the probe not naked indeed, but near the course of my incision. With the point of my finger I cleaned the parts, wrought with sponges, left the artery of the groin quite free; but still not one drop of blood issued from either wound*."

Thus was Mr. Duschamps left in great confusion; certain, by the direction of the wound, and by the bleeding, that the chisel had touched the femoral artery; uncertain only where to apply his ligatures, or how. He was, moreover, perplexed with the doubts of his assistants, who not having seen the bleeding, and seeing and feeling now the strong beating of the artery, feeling also the entireness of the pulse in the lower part of the limb, could not believe that the wound had touched the main trunk. They were also the more inclined to doubt this, from their not understanding what the blunder was which Mr. Duschamps had committed (viz. cutting on the wrong side of the artery), which made it difficult for the artery to bleed, and impossible for them to see it bleed, whether it was wounded or not.

Something they saw must be done; Mr. Duschamps, therefore, cut and dissected nearer and nearer to the artery, and came as close to it as he safely could. The probe put into the wound of the chisel, seemed to touch the artery at the very point where it passes through the triceps muscle; he therefore struck one ligature below the artery, half an inch under the point of the probe, and of course, half an inch under the passage through the triceps. By straitening this lower ligature in a temporary way, the blood was stopped in the canal of the artery, and the artery was forced to bleed above; by this mark, the upper ligature was next put round the artery, higher than its wounded point, and the loop of

* "En présence de MM. Chopart, Boyer et autres, je procédai à l'opération de la manière suivante. J'introduisis une sonde dans la plaie; sa direction, que j'eus de la peine à suivre, la conduisit vers l'artère femorale, à-peu-pres à l'endroit où elle passe à travers le tendon du grand adducteur. *Sans avoir égard à cette plaie*, je fis une incision de la longueur de six à sept travers de doigts sur le trajet de la fémorale, de manière que le lien ou la blessure de l'artère pouvoit être supposée, se trouva dans le milieu de l'incision; les tégumens ouverts, je pénétrai à travers le muscle qui couvre l'artère avec toutes les précautions nécessaires jusqu'à ce que son battement me fut sensible.

"Comme il n'y avoit aucun épanchement sanguin, et par conséquent aucune cavité, il me fut impossible de mettre l'artère parfaitement à découvert. J'en approchai le plus près possible, et autant que la prudence put me le permettre. Celle-ci, blessée à sa partie *postérieure*, ne me presentoit aucune ouverture."

this ligature being also tightened for a moment, by pushing the point of the finger under it, immediately suppressed that bleeding, which the tightening of the lower ligature had produced. Every thing being thus settled to the satisfaction of Mr. Duschamps, the ligatures were drawn close and tied, the bleeding was suppressed, the wounds were dressed lightly, and every thing went on well for seven days; the limb had recovered from the loss of its main artery, and what is always more doubtful, the artery itself continued secure. But on the seventh day, those secondary bleedings came on by which so many patients have died; and it was after encountering great difficulties, after many burstings of the artery, after much loss of blood, and, of course, an irreparable injury to his constitution, that this young man was saved. In short, they saved with great difficulty a young man of a laborious profession, in the very prime of life; the arteries young, and in that flexible condition in which we should have the best hopes of procuring a speedy adhesion, of making an uninterrupted cure! This is a case which presents the following question strongly to us, "Why should not the artery have kept steady the very first tying, if it was possible to keep it steady in the end?" But as I have passed already through all those rules which direct the manner of securing any great artery, I refrain from mentioning many of the unfortunate accidents of this case, keeping plainly to the point in question.

It is sufficient to say, that Mr. Duschamps had made mistakes in the very beginning of this case, which never after could be corrected; and all the frequent yieldings of the artery, and the terrible loss of blood, were owing merely to the arteries being irregularly tied.

What business had Mr. Duschamps to trust so much to his own knowledge, as to make an incision in the course of the artery, when he might so easily have taken the plain direction of the wound? Why should he have looked on the inside of the femoral artery for the wound which had reached it from without, and which he might have known had touched the artery only on its side or back part? At the time when he might have seen his mistake, why did he continue cleaning and working on the inside of the limb, at the incision which he himself had made, when he might so easily have enlarged that wound, through which the point of the chisel had touched the artery? Surely, if the wound was not on the fore-part of the artery, where he was looking for it, it must have been behind: Why then did he continue dissecting, with much danger and difficulty, upon a sound part of the artery, when he might have gone to the wound of the

chisel, and dissected the artery at a place where, being already wounded, it would have been less unfortunate, even should he have touched it again? But what temptation, above all, had he to forsake the course of the natural wound, since he had seen (when with his own hand he first lifted the dressings) a high arch of blood thrown directly from that wound? As Mr. Duschamps durst not make his dissection so clean, as absolutely to touch, or to surround, or to insulate the artery, what had he to expect from the deep stroke of his aneurismal needle, with which he placed the ligature? Nothing surely, but that it should suppress the bleeding only for the time, to burst out more furiously when the flesh under the ligature faded, and more dangerously, since it might burst out suddenly in the night, perhaps after the attendants were exhausted with watching, or when by use and custom they were grown careless and too secure.

That the slackness of the ligature was plainly owing to the fading of the parts which were included along with the artery, is proved by the following passage: "When on the evening of the seventh day a violent hæmorrhagy came on, I lifted the dressing, and found the ligature so relaxed, that it had no longer any purchase upon the artery, having in a great measure cut through the muscular flesh *."

Had the dressings been lifted, and the ligature found thus slackened twenty-four hours after the operation, I should have thought Mr. Duschamps not far wrong in saying, "for the ligature had cut through the muscular flesh." But when on the seventh day he finds this ligature slackened, and the muscular flesh gone, he should have said rather, "the muscular flesh under the ligature having gangrened, and being consumed, I found the ligature quite loose."

You must next observe, that the depth and obliquity of such a wound, prevents the bleeding at first; and that often it is not even suspected that an artery is wounded, when suddenly, on the tenth or twelfth day, it bursts out with such violence, as to endanger the patient's life. It is not in gun-shot wounds alone that this happens, where the artery is not actually open till the slough falls off on the eighth or tenth day, but in clean wounds with a pike or bayonet! for in those only, could the delay of hæmorrhagy be attributed to the obliquity of the wound. In the practice of the older surgeons, we have many examples of this, for in their

* Je levai l'appareil; à l'examen, je trouvai la ligature relâchée, et telle qu'elle n'avoit plus aucune action sur l'artère, les parties musculaires, comprises dans la ligature, étant en partie coupées"

days duels were frequent, and were always fought with the sword, and when a gentleman was wounded in the sword-arm, it often happened, that although the sword had run obliquely along from the wrist to the elbow, and wounded the brachial artery at the bend of the arm, no bleeding appeared outwardly, the first issue of blood was so resisted by the cellular substance, that it soon coagulated, and filled up the narrow wound, assisted by the inflammation and swelling of the parts. A firm coagulum was formed, and it was only on the tenth or twelfth day when the suppuration was free, and the clot began to separate, that the blood burst out. Le Dran's Forty-eighth Observation, contains the case of a gentleman in the regiment of Noailles, who was thus wounded with a rapier in the sword-arm; the slight bleeding was stopped with small dossils of lint, and the next day his hand and fore-arm were in good condition. Le Dran, in examining them, found no symptoms of a wounded artery, there was a little ecchymosis towards the elbow, and a moderate swelling of the whole arm. The dossils were at last withdrawn, the cure went on well, the pus was formed, the arm was not swelled, no symptoms of a wounded artery appeared till on the seventh day in the afternoon! Being pressed to go backward, he went behind his tent with his arm in a sling, and having, in adjusting his clothes, either streightened or twisted his arm, a considerable hæmorrhagy appeared suddenly. When the consultation met next day, it was plainly seen that the artery was open, the bloody tumor now extended from the elbow to the arm-pit, Mr Le Dran advised the opening of the tumor, or the amputation of the arm; his advice was neglected; the army made a movement; this gentleman was sent to Namure; the hæmorrhages returned; the surgeon was long in resolving on amputating the arm, and when he did at last perform it, the gentleman was so far exhausted by successive hæmorrhages, that he died.

This artery was found, upon dissection, to be wounded above the condyle, and a hard clot of blood which pressed it down against the bone prevented the bleeding*.

* In the 50th Observation of Le Dran, is a case very singular and interesting, where a young gentleman, wounded in the fore-arm in a duel, had a great swelling in the arm from the elbow to the arm-pit, hard, black, and ecchymosed. He had violent pain in the palm of his hand, there was no pulsation in the wrist, the hand was cold; by proper treatment the tumor diminished, the pulse and the natural heat began to return, and the pains were less acute, when one night the patient moving his arms awkwardly in bed, felt something extraordinary, which disquieted him the whole night, and the next morning his surgeon found the swelling returned, &c. This case illustrates several of the principles which I have explained in treating on aneurism, it is a case of wounded artery obliterated by the pressure of the aneurismal tumor

Thus, it often happens through mismanagement, that the swelling, the hæmorrhages, the gangrene suddenly terminate in death, but in such wounds, the case is often protracted to a greater length, displaying as it were in detail, all the dangers of an oblique wound.

A ball, we shall suppose, passes along the fore-arm, rakes along the two bones, wounds the radial or ulnar artery in the bottom of a deep and narrow wound, and then passes out beyond the elbow, making an opening too small to let out the blood; or we shall suppose the oblique stab of a knife, sword, or bayonet, touches an artery, lying thus in the heart of the fore-arm, under all the muscles, and close upon the bone; then the following consequences ensue. The profuse bleeding, at first, proves that some artery is wounded; the direction of the wound ascertains that it is the radial or ulnar artery; the stopping of the outward bleeding, causes an internal aneurism, different from the greater aneurisms of the arm or thigh, as it lies not under a fascia, forming a fair circumscribed aneurismal bag, but under the bellies of all the muscles, which are separated from the bones, by a very irregular and a very dangerous collection of blood. The outward bleeding is soon stopped by compresses, and a bandage; the friends are less alarmed, seeing nothing but a narrow slanting wound; but when the next morning, they see the arm black with the injected blood, and swelled to an enormous degree, their fear is like their indifference, before quite ignorant, and beyond the true measure; they believe this to be an absolute gangrene, and that the patient is lost; while the surgeon sees in this blackness, not the signs of gangrene, but the marks of a wounded artery, and foresees a difficult and tedious operation of seeking it out.

But if again the surgeon have not the skill to perceive all the dangers of the case, the apparent gangrene is soon changed into a real one; the limb becomes cold, benumbed, and has a livid redness upon its surface; the skin without runs into a low inflammation; the blood within increasing every day in quantity, corrupts and bursts out; and thus, as I have hinted before, it is not merely by the wound of its great artery, and by losing the great trunk that nourished it, that a limb is lost; but in a case like this, it is lost by the deep driving of the blood a-

which rose over it; the blood was gradually discoloured by suppuration, the pulse of the wrist was gradually restored in consequence of the enlargement of the collateral arteries, it is a proof that the internal hæmorrhages which fill up the measure of an aneurism are successive, which is the reason of the irregular growth of aneurism, and of its enlarging in proportion to the freedom the patient uses with the limb.

mong the flesh and bones. Either the outward bleeding is allowed, and the patient is in danger of immediate death, or the blood is confined, and the bleeding goes on within ; so that every time the artery bursts out, the limb is injected anew, as it were, by the arteries, and is in imminent danger of gangrene at every new effusion of blood. The matter is bloody, fetid, corrupt ; it prevents the reunion of the bones (if any bones be broken), it makes foul suppurations, and extensive and fetid fores ; and each new suppuration is succeeded by a dissolution of those clots which had for a time stopped up the artery, so that again the blood bursts out ; till at length, after many months of suffering, the patient is forced to part with that limb which he has undergone so many dangers to preserve. The extensive sinuses, and foul fores, the disorder of the joints, and the total caries of the bones, makes every such case incurable ; there is, even from the very first moment, no other alternative for the surgeon, than either to perform immediately a bold decisive operation, or to resolve at once (not keeping the patient in this lingering and cruel condition) to cut off the limb. To the patient himself the question may be honestly proposed in these terms : " Will you have this tedious, but necessary operation, of tying the artery, regularly performed ? Or will you, to shun a present pain, linger for months in this miserable condition, consenting at last to lose the limb, when it is perhaps too late to save your constitution, or even your life !"

This is the full description of that case, which I hinted at in the beginning of this discourse, when I said, that sometimes the arteries are wounded deep among the muscles, and there the blood corrupting the muscular flesh, and even spoiling the bones, is the occasion, after long suffering, of the patient's losing often his limb, and sometimes his life. Nor is it necessary to produce all those mischiefs, that along with this wound of the artery, there should be a fracture of the bone ; the most simple puncture of the small sword, pike, or bayonet ; the mere wound of the artery, often costs the patient his limb. But the case, though naturally dangerous, and requiring severe and bold operations, is rarely fatal, except from want of resolution and want of knowledge on the part of the surgeon.

The first surgeons cannot be in all parts of a field of battle. The wounds, in the first instance, are dressed, and conducted for some days by young men ; it is only when the patients arrive at some general hospital that their wounds, or rather the consequences of their wounds, are rightly understood. The wounded arteries are

generally no better secured than in the case related by Belloste in his Hospital Surgeon: "It is the case of one Beaulieu of the King's battalion who was wounded with a sword between the radius and ulna; he remained eight or nine days in his quarters, being dressed by one of the mates, who, without making any diversion, only shut up the wound with a *strong stopple*, which restrained the great flux of blood between dressings, but in time of dressing, he bled excessively. The blood which was extravasated in the member did there corrupt, and caused abscesses in several places, but at last his surgeon seeing that his strength daily diminished, and fearing some fatal accident, sent him to the general hospital*." Belloste, in this case, made the same use of pellets of lint, dipped in vitriol, that you would make of sponges, by thrusting them down to the bottom of the wound where the artery was open.

In the fighting of duels, slanting wounds in the sword-arm were often cured by the suckers; by sucking the blood, by compressing the wound, by a gentle bandage and flinging the arm; they were, in plain terms, cured by adhesion. But when in place of being a simple wound, the artery was punctured, the consequences were often fatal.

Bohnius, in his book de Renunciatione Vulnerum, relates a case which I cannot but consider as an instructive instance of ignorance and negligence. He was called to attend a young man of the first family in the province, who had been wounded in the fore-arm a little above the wrist, the wound was narrow indeed, but it reached nearly from the wrist to the bend of the arm, the weapon passed under the skin and muscles, it had raked along the bones, and twice in the course of ten days had the blood burst out furiously, and per saltum. The arm was swelled, the fore-arm extremely painful, a livid redness extended to the shoulder, and this gangrenous swelling burst in about three days after, at the bending of the arm, discharging a bloody and ferous matter, with some abatement of the fever, swelling, and pain. But from the time of Bohnius being first called, there was for thirteen days no eruption, but on the thirteenth day it burst out most impetuously; two days after the blood burst out again; and eight days after this, the blood burst out again most furiously at both wounds, i. e. by the punctured

* Belloste, after relating the difficulties he had to struggle with in saving this man's life, concludes the case with this prudent reflection, as he terms it: "This kind of wound, where arteries are opened, are of all others the most ticklish, they give great a deal of *trouble*, and but little *reputation* is gained by the cure."

wound near the wrist, and by the greater opening where the fore-arm had burst from gangrene. This young gentleman was wounded on the 3d of September, and after two months of pain and suffering, frequent bleedings, and continual alarms, he expired on the 9th of November.

Upon dissecting the arm, it was found, that the sword passing along under the muscles from the wrist to the elbow, had slit up the radial artery for the length of half an inch, exactly up to that point where it comes off from the brachial artery. The lips of the slit were callous and hard.

Even Bohnius, a man of high rank in our profession, makes a poor apology for the death of this fine young man, "that an artery wounded at so great a distance, it was impossible to see*." How, indeed, could they see the artery? they never had dilated the wound, nature had indeed done something towards showing them the artery, the arm had burst over the very place where the artery was wounded, (viz. in the bend of the arm) but on their parts they had done nothing; they had crammed this ulcerated place where it had burst with doffils, but the wound they had never dilated; Bohnius, even to the day of the patient's death, speaks of it as a puncture.

Here are lessons of no small importance. The case proves, 1st, What destruction this kind of aneurism will produce, viz. gangrene and bursting of the arm. 2d, How long the artery will continue open, gradually bleeding the patient to death by successive eruptions of blood. 3d, That however painful your operation is, it must not be neglected, else the patient must suffer, and when at last the danger becomes apparent, although you should resolve to cut off the arm, it will be too late! to cut off an arm so gorged with extravasated blood, so swelled and inflamed from the wrist to the shoulder, would be to commit a deliberate murder.

You now understand why an experienced surgeon will make deep incisions, where a man of less skill would find no danger. An experienced surgeon would make incision into such a wound at once! If the young surgeon shrinks from so hardy an operation as that of dilating a deep and slanting wound, it is because he is not aware of the danger.

These consequences are not limited to any part of the body; wherever an ar-

* "In præsentiarum innuere sufficiat difficultatem medendi huic hæmorrhagiæ deplorandæ, quæ in illo præprimis videbatur consistere, quod vulnus arteriæ sanguinem fundentis a vulnere externo adeo distaret, ut ejus situs determinari haud potuerit." BOHNIUS, page 48.

tery, of considerable size, yet not large enough to create a formidable aneurism, is wounded deep under the muscles of the limb, the consequences are the same. But if the wound be produced by a ball, and if the bones be fractured, the destruction of the limb is almost inevitable. I have extracted for your use, the following instructive case from Mr. Allanson's book on Amputation.

Harry Knowland, a seaman, was wounded in an engagement, with a ball, which entered under the patella, broke the tibia and fibula obliquely near their upper end, passed obliquely through the leg backwards, and a little downwards, and came out at the middle of the calf of the leg, followed by a great bleeding from the wounded arteries, and many splinters of bone*.

A well instructed surgeon would have made a large and bold incision, laid open the wounded vessels, that he might tie them; would have picked away all the looser splinters of bone, but would have been careful, above all, in tying the arteries, knowing that if they continued to bleed outwardly, the patient might die; if inwardly, that they must inject the leg so strongly with blood, that it might fall into gangrene, and would, at all events, run into a foul and gangrenous suppuration; that the bones also, far from reuniting, would, in a few weeks, be thoroughly and irrecoverably diseased.

A fortnight after this wound, nothing having been done, meanwhile, to save his limb, this man was carried on shore and put into the Liverpool Infirmary, where he lay four entire months. At first his knee and the whole leg were great-

* As one proof of the necessity of cutting boldly, observe what Gooch says, p. 341. "Among the rest of our conversation at this time, there was mentioned a case, in which one of the arteries betwixt the tibia and fibula was opened about the middle of the leg, and the bleeding was stopped from time to time by various methods, but at last it was thought advisable to amputate the limb." Mr. Gooch proposes rather to cut out two or three inches of the fibula, and so expose the artery; and I would add, that I should rather do any kind of operation, however cruel and tedious, than cut off the leg.

The imprudence of confining the blood, or of delaying the operation, is well explained by the notes which our old Surgeon Wiseman gives us, of a case in which he was trying to cure a popliteal aneurism by astringents and by compression. He informs us, p. 122, "That while he endeavoured to keep the blood within the abscess, it insinuated itself between the muscles, making the calf of the leg hollow to the very tendon." This, we find, obliged him to make long incisions through the calf of the leg, before he could accomplish the cure. In short, whether the artery requires to be tied, or whether the bleeding stop, we should neither confine the blood nor procrastinate our operation; nor make our incision too small; for the driving of the blood in this lesser, as in the greater aneurisms, disorders the soft parts, spoils the bones, puts the artery further out of our reach, and makes the abscess extensive, the operation difficult, and the cure tedious; small incisions also prevent the artery being well seen or clearly tied.

ly swelled ; the leg and foot cold and œdematous, with a very languid circulation through the whole limb : He had moreover a fever upon him, with a great depression and languor, a foul tongue, and a small quick pulse.

When the bullet holes were first dilated, there issued a great quantity of sanies highly fetid, mixed with clots and putrid blood ; and bark and wine were used during this putrid or gangrenous state ; and free dilatations were made when the time arrived, for giving vent to the foul suppurations.

In the course of this tedious case, the callus often began to form, and the surgeons entertained hopes of accomplishing a cure ; but the deep seated hæmorrhagy continually returned upon him, coagulated blood was accumulated anew in every part of the limb, with a new discharge of putrid sanies, new sinuses, new suppurations ; and thus, from time to time, the incipient callus was destroyed.

Four months they struggled against these disappointments and difficulties, supporting him all along with diet and wine, often dilating the openings for the putrid sanies, and sometimes extracting the splinters of bone, till at last such a bleeding came on, as put an end at once to all hopes of a cure. The whole limb was relaxed and swelled ; the cellular substance gorged with coagulated or putrid blood ; the hæmorrhage came deep from among the callus, from the very centre of the limb ; the man was quite emaciated ; his stomach was so enfeebled, that he could receive no solid food ; his health was already broken, and it appeared imprudent to struggle longer, it was plainly impossible to save the limb ; it was accordingly cut off*.

The plain rule resulting from this case needs hardly be explained ; it is scarcely more than a recapitulation of that rule which has been already delivered : but it puts it in a stronger point of view, viz. that we should cut boldly ; seek freely for the artery ; tie it securely with the needle : and it is only where the artery can by no means be taken up with the needle, that you are at all to trust to the sponge, and even then, not willingly, nor without every precaution of firm compresses, tight bandage, a tourniquet put lightly about the limb to secure the patient from any deadly hæmorrhagy, and the appointing of attendants well accustomed to such a charge.

* Upon injecting the amputated limb, the wound was found to be in the posterior tibial artery. It had been cut entirely across by the ball ; the upper end indeed had, by some accident, closed up ; and at the final hæmorrhagy, perhaps also at many of the former hæmorrhages, had come from the lower end of the wounded artery, the blood having returned freely by the anastomoses of the foot and leg.

The thoracic artery, though small and apparently unimportant, produces often the most distressing consequences when wounded, and requires a bold operation. This arises from the looseness of the cellular substance which surrounds the great vessels and nerves in the axilla, and such is the power of this long and slender artery over the cellular substance, that it drives its blood freely under the pectoral muscle. The aneurism which it forms is as large sometimes as that of the thigh! It often happens after a wound of the thoracic or external mammary artery, that the whole side is blackened with the suffusion of blood; the great cavity of the axilla itself is filled with blood (and it is capable of containing a great quantity), the back and breast are black with the ecchymosis. The appearance is so formidable that the surgeon suspects some mortal wound; the side is so loaded with blood that the patient is oppressed, and he labours so in his breathing, that we should believe him wounded in the thorax, but that there is no cough nor blood coming up from the lungs, nor emphysema from air issuing by the wound. From the size of the aneurism in the axilla, one would, on the other hand, be apt to believe the axillary artery itself wounded, but that the pulse at the wrist continues firm. When the axilla is thus filled with extravasation, and the back and breast blackened with ecchymosis, a gangrene of the skin must sooner or later ensue; the discharged blood will become foul and very fetid; the destruction of cellular substance and the irregular abscesses must extend far and wide; the disorder will be several months in being cured; it arises from ignorant surgeons thrusting their stoppels of lint into that wound, which is very distant from the place where the wounded artery lies, which of course continues to bleed within.

This must be prevented. It would no doubt be very wrong to cut up the axilla, or touch the pectoral muscle in pursuit of every trivial artery that may be wounded on the fore part of the breast; nor would it be sensible to make incision always when the long pectoral artery itself is wounded; for often the thoracic arteries, when wounded with swords or musket shot, bleed very smartly, and yet stop of their own accord, upon applying merely a piece of lint to the wound. Indeed it is not on account of the actual wound of the artery that we perform any operation, but to prevent the destruction of the cellular substance and the diffusion of the blood; therefore when you find that applying a piece of lint with slight compression stops the bleeding, without any appearance of extravasation, you remain satisfied. But if you be called to your patient a few hours after the first dressing, on account of an incipient swelling and slight oppression of the breast,

and find that the extravasation among the loose cellular substance in the armpit is begun, you must undo your bandages, withdraw your bit of lint, which is merely a stopple confining the blood, dilate the wound, put in your finger and advance it till you feel the jet of warm blood; hook out the clots which lie over the mouth of the artery, and lay your compress directly upon it. Then pile compresses over it on the outside and apply your roller; for it is seldom necessary to cut the wound entirely up, or to use the needle in wounds of the thoracic artery.

In the time of Belloste surgery was ill understood; he was a sharp remarker, and we have numerous instances of misconduct mentioned in his little book. Among other cases I find the following: "If at first we join the lips of a wound and apply astringents upon them, the outward bleeding may be depressed before that of the vessels is restrained, and so the blood running betwixt the muscles may there be corrupted, and may spoil the parts wherein it is contained and those that border upon them, and may also occasion suffocation and a gangrene. This is what I saw at Turin befall the Baron de la Serra, a gentleman of Savoy, who was wounded with a sword near the right armpit, and had a branch of the vena subclava opened. He was dressed by a very expert surgeon, who, whether by chance or otherwise, neglected to apply astringents to the aperture of the vessel, though the bleeding was very great. The wound was joined, and the part loaded with astringents, which were made fast with compresses and bandages. In the mean time the blood continued to run from the vein and to diffuse itself between the muscles of the breast. Two or three days past before the first dressings were taken off, and then the thorax was found to be gangrened; the wounded person died in a little time after." Here then I conclude my observations on this diffused aneurism.

RULES FOR STOPPING THE HÆMORRHAGY, FROM ALL SMALLER ARTERIES.

1. Styptics can avail us very little in any dangerous hæmorrhagy, and they stand in our list, chiefly because they were valued by the older surgeons, who, though they used the needle, never could rid themselves of all their prejudices, nor use it freely. With us styptics are little valued, we never think of using them, except in bleedings from arteries of the very smallest size; where the hæmorrhage is of so little danger, that we would not trouble our patient with the

sharp pain, which the needle causes ; we do not use them where we see the bleeding artery, or where we can use the ligature or the compress ; we find them useful, chiefly in oozings of blood from hollow passages, as in bleedings from the nostrils, the gums, the throat, the alimentary canal, or womb ; or in bleedings from foul ulcers, from the cavities of deep sores, or from any broad and diseased surface, where the bloody exudation may be checked, and the condition of the surface improved at once, by the stimulant nature of our styptics. The best of these slighter styptics are diluted vinegar, spirits, mineral acids, or solutions of alum.

2d, There are also cases, where we should choose to disregard the bleeding from the smaller arteries, even though they be of such a size, as to be seen throwing out their blood by jets ; indeed, we perform few operations, in which we do not see little arteries throwing out their blood, which before we have finished our incisions, have shrunk, and have so injected the cellular substance round about them, that it is thickened, and their mouths are closed ; such arteries are no more troublesome, and the cure goes on well. In like manner, in wounds, and in operations also, we often see little arteries opened, which we disregard altogether, allowing them to exhaust themselves ; we keep the wound exposed to the air, and when the bleeding and general oozing relents a little, we clean it, at least we clear away the grosser clots of blood, which might prevent its re-union. Then laying the lips of the wound together we place our compresses in such a manner, as to press the lips of the wound against each other, and likewise against the bottom of the wound ; so that these compresses, which thus procure the adhesion of the wounded surfaces, prevent, at the same time, any further bleeding within. The bandages of such a wound ought to be painfully tight at first, and may be slackened in a few hours.

3d, In all hæmorrhages, where we have a full and rather a dangerous bleeding, and in which we see distinctly one or two great arteries or veins throwing out blood, the bleeding must be suppressed either by the ligature or by a steady compress, and the ligature, wherever we can use it easily, ought to be preferred.

4th, If an artery of a smaller order, and lying firm against some bone, as in the hand, or foot, or temple, be cut ; if either by a punctured wound a small aneurism be formed, as in the wrist or at the root of the thumb ; or if by a blow the artery be hurt against the bone and bursts, so that a small beating aneurism ensues ; we do not, in such case, always go regularly to work, we do not choose to give the

patient the pain of opening such a tumor ; but sometimes by departing from the general principle, we manage the particular case more easily ; we apply a compress, which being tied down hard and firm for two or three days, obliterates the artery, by pressing it against the bone. The blood of such a trivial aneurism is as easily absorbed as that bloody tumor which we see so often on the heads of children immediately after birth, and which we are accustomed to disregard. The compress is like that with which we stop the Temporal Artery, after opening it with the lancet.

5th, The manner of making compression to obliterate an artery must vary according to the circumstances of the case : Sometimes, as in small and superficial aneurisms, it should be made above the skin, and on that part of the artery where it enters the small aneurismal effusion ; and the artery which feeds the aneurism being thus obliterated, the blood already extravasated will be absorbed, and the little tumor itself will quite disappear, leaving but a slight thickening, or perhaps none. Sometimes, as in wounds, we make the compression within the wound ; and for such a purpose there can, perhaps, be no better nor firmer compress than a small pellet of chewed paper, a piece of cork, a piece of folded leather, a piece of firm sponge or agaric, or a firm compress of folded linen ; any thing, in short, will do for a compress, if it be but firm in itself and neatly applied.

The compress thus introduced into a wound, and placed upon the mouth of the bleeding artery, must unavoidably interrupt the cure by adhesion, but this is only for a few days ; for when it is withdrawn on the second or third day, the parts may then be laid together so as to adhere.

6th, But the arteries of the wrist, the palm of the hand, the fore part of the foot, &c. are of so great a size, that though when bruised, or hurt, or stabbed, and the skin healed over the wounded vessel, the aneurism is commonly of a trifling size and easily cured ; yet in open wounds where these arteries are cut by working tools, a carving knife, &c. in the wrist or the foot of a large and strong man, there ensues a scene of terrible confusion and perplexity ; which perplexity, is itself the chief cause of such loss of blood, as often injures the constitution, when it does not endanger the life : for the friends gather up napkins and cloths confusedly, wrap them loosely and in a hurried way round the limb, and each cloth, as soon as it is soaked in blood, they remove, as if they had no other intention than the childish one of hiding from the patient what quantities of blood he is losing ! while, if in-

stead of this general compression of cloths wrapped irregularly round the limb, they could have but the boldness to look upon the wound, and press upon the very point where the artery is bleeding, they might, with one finger only, suppress it, and with a single touch. Then, let the recollection of this be a lesson to the surgeon, and let the very sight of this confusion put him in mind of his duty, which is to strip off these confused bloody cloths as quickly as possible, and press the point of his thumb or finger directly upon the bleeding vessel.

7th, The bleeding being thus restrained, let the surgeon clean the limb, appoint his assistants, lay the hand upon a table and pillow; or if it be the leg, lay it out firmly upon a stool. If he have no good assistant, let him make a temporary tourniquet with a common garter and a piece of stick; but if he have any professional man to help him, then he should still prefer the suppressing of the bleeding with the point of his finger, because in a moment he can let go the artery and can close it again as suddenly; in short, he can let go the bleeding artery more quickly, and can look at it more frequently, and with less loss of blood, than in using the tourniquet. Having thus fixed his eye upon the bleeding artery, he either draws it out with the hook or forceps, or he strikes his ligature under it with the needle; or if neither of these can be done, he puts either a regular tourniquet or this occasional tourniquet round the arm, and cuts up the wound freely, till he sees the artery bleeding with open mouth.

8th, Whatever blood the patient loses before a surgeon arrives, is part of the natural danger of his wound; but it is a great disgrace to the surgeon if he lose much blood afterwards. Successive bleeding, successive divisions with the needle, the taking in of arteries, tendons and nerves, all in one great ligature! and hæmorrhagies still succeeding to these clumsy operations, are far from being honourable to the surgeon; especially since these wounds of the fore-arm, or leg, or hand, or foot, are in parts where we may use greater freedom. The surgeon, then, should do his operations boldly; he should not be sparing in his first incisions (if he have but knowledge enough of the cross ligaments, tendons, and nerves, to make such incisions safely); for if once he suffer this wounded artery to assume an aneurismal form; if he oppose the blood by slight compresses, permitting it all the while to bleed within; the artery will shrink, the cellular substance will be crammed with blood, and the skin thickened also by inflammation. The seeking out of the artery among such a confusion of parts will be inconceivably difficult, both because it does not bleed so as to direct us, and be-

cause it lies deep, and because the surgeon cuts very timorously ; for even a bold man will be apprehensive when he finds himself cutting through parts which he does not understand ! and, in this particular case, the parts are so massed together, that he can distinguish no one part from another, unless he prolong his cut either above or below the place in which the blood is extravasated where the arteries are free. In short, as he cuts through two inches of confused substance, and on so naked a part as the wrist (e. g.) he hardly doubts that he is cutting through muscles and every thing, while in fact he is cutting only through the skin, thickened to this degree by inflammation that has lasted for two or three days, and by the continual driving of the blood.

The rule which arises out of this representation of the case is very plain, viz. not to be sparing in the first incision ; to do this first and great point of the operation decidedly and boldly. The leaving no doubt about the tying of the artery, and no possible occasion for future incisions, is in the end the greatest saving of pain ; the first operation is easier than the second, and the second operation is easier than the third. It is owing to this misplaced lenity of making small incisions at first that any second operation is ever required : It is owing to a want of still greater boldness in the second operation, that a third is ever required ; and we know too well how often a want of success in the third or fourth operation has tempted the surgeon to cut off the limb *.

* It cannot be superfluous to remark here, that those who have the brachial artery tied, as in aneurism at the bend of the arm, recover the pulse of the wrist, but that those who have the radial artery itself wounded have no pulse at the wrist. The compression obliterates always a considerable extent of the artery, and the ligature itself obliterates the canal of the artery for some space above and below that where it is applied.

I once dissected a patient who laboured under paralysis of one side ; the pulse in that arm was entirely wanting. This very singular accident gave rise, before the patient's death, to many ingenious speculations, not unlike the lucubrations of the celebrated Haller, in his thesis "On the Influence of the Nerves over the Arteries ;" but the man died. I dissected his arm, and found the artery obliterated from the middle of the arm through the fore-arm and wrist. It was firm and cord-like, resembling the hypogastric arteries.

Tulpius, page 258, observes a frequent *lusus naturæ* of the radial artery, which, in place of running along the fore part of the wrist, turns round, and is felt only at the root of the thumb ; and tells of "one of the senators of the Batavian republic, whose physician not perceiving any pulse at his wrist, pronounced him ill of the plague." But I am speaking of the pulse ceasing from wounds of the wrist. In the sabre wounds which horsemen receive, this is often a consequence. One old author mentions, that in a military hospital of Polish and German hussars, he saw many instances of this, and at first did not know the rea-

9th, The sponge is often more useful than the needle, and that, too, in cases of the greatest danger. Wherever the wounded artery lies deep, and we cannot cut for it, on account of the nearness of some great artery or important nerve, as, for example, in the axilla, about the neck, or about the angle of the jaw; wherever the bleeding artery is so nitched in between two bones that we cannot draw it out with the tenaculum, nor reach it with our crooked needle, as, for example, in the fore-arm, or between the bones of the leg; in short, wherever we cannot see the artery, or cannot strike it safely with the needle; wherever the bleeding is not so much from a particular artery as from a general surface; or wherever the blood is thought to flow rather from great veins than from arteries (as in tearing out cancerous glands from the arm-pit); in all such cases we use the sponge, and we use it in the following manner: We keep the sponge dry and hard compressed, and always ready for use, and when it is to be used, it is cut into small pieces, square or long, as the incision requires, and small threads are tied to the sponges, by which they may be drawn away in due time. In any dangerous hæmorrhagy of this kind, we choose out a piece of sponge proportioned to the size of the wound, thrust it down to the bottom of the wound, fix it there with the point of the finger, either expressly upon the mouth of the bleeding artery, or if that cannot be distinctly seen, upon the place at which the artery bleeds; then lay one compress above the sponge, a second compress above the first, a third above the second; and taking care to keep the compresses always steady with one finger, to prevent the blood soaking into the first sponge, and

son of the want of pulse, till some of them showed him the scars of their wounds. Perhaps the most pertinent anecdote is the little wicked story which Turner tells of one of the physicians in his neighbourhood, to whom he had no particular liking; indeed the harmony betwixt the two professions was in his days but very imperfectly established. The servant girl of a public-house in his neighbourhood, at the sign of the Swans, had fallen with a basket of bottles, and cut her wrist. After various attempts to secure the artery, and many terrible bleedings; after the surgeons and apothecaries of the neighbourhood had used their flour compresses, styptics, vitriol buttons, &c. all in vain, every slough proceeding from the vitriols having brought on new bleedings, Turner at last, with the assistance of his neighbour Mr. Henry Boon, suppressed the bleeding with the actual cautery, which he seems, indeed, to have twisted about and thrust upwards under the tendons with very singular dexterity!

The girl entirely recovered. She fell ill of some slight indisposition, and a physician, Dr. P—r, being called to visit her, was carried up stairs to the garret to Betty's bedside, where she lay sound asleep. He took hold of her wrist, examined it again and again, found no pulse. Dr. P—r came down to the parlour, and declared the girl past all possibility of recovery. The family running hastily up stairs, wakened the girl, to the great humiliation and confusion of Dr. P—r.

distending it, we pile one compress above the other, till the whole rises so above the level of the wound, that our bandage operates well upon the whole of this pile, which is called the Graduated Compress.

I advise you, on such occasions, to keep your tourniquet screwed during the whole operation, that you may not be troubled with blood; to slacken it slowly, that the dressings may not be discomposed by the too sudden return of blood; and still let your tourniquet remain loose about the limb, and ready to be screwed if the artery should bleed again.

Yet once more, before I forsake this subject, I must endeavour to impress you with a conviction of the danger of entering upon the profession of surgery (where all the most alarming accidents and trials come upon you suddenly) without a perfect knowledge of anatomy. From the earliest times this has been the conviction of the most eminent men; this is indeed a subject on which I should choose rather to argue from authority, than to quote invidious facts. I should not choose even to remind you of the murders which are related in books of the rude Arabian surgeons, yet that surely could give no offence. Albucasis, in the preface to his book of surgery, relates many. He himself saw an ignorant surgeon, in opening a scrophulous abscess in the neck, cut the arteries, so that the woman fell down dead under his hands. "Surgery," says Albucasis*, "has fallen to a very low state. The art has in these regions degenerated, it is almost forgotten; and this is the reason why no good operators are found! Our art is difficult, and should be attempted by no one who is not exercised in the science of anatomy as taught by Galen, till he knows the forms and articulations of the several members, their bones, nerves, sinews, with the place and number of each, and the course and egress from the body, both of the pulsating and of the quiescent veins." Every artery, indeed, should be thoroughly known to the surgeon, from the smallest, which are stopped by lint or compression, to the greatest which form the aneurism of the arm or thigh! from the arteries of the wrist or temple, which you can hold with the point of one finger, and catch with the needle easily! to the arteries of

* "Quoniam operatio cum manu prostrata est in regione nostra, et tempore nostro privata omnino. Donec fortasse periit scientia ejus, causa autem propter quam bonus artifex de ejus cum manu sua in hoc nostro tempore est quia ars medicinæ est longa, et oportet auctorem ejus exercitari. Ante illud in scientia anatomiae, quam narravit Galenus, donec sciat juvamenta membrorum et ipsorum formas et eorum conjunctionem et separationem et habeat cognitionem ossium et nervorum et lacertorum et numerum ipsorum, et eorum egressionem, et venarum pulsationem et quietarum et locorum exitus earum."

the groin or armpit, which bleed so, that the patient can hardly be saved by the most rapid and dexterous operation.

But let a man study with what diligence he will, anatomy can never be perfectly remembered. The surgeon should from time to time revise the tables of the arteries. Drawings no doubt can be of little service to those who are not thoroughly schooled in anatomy; but to one who is, or who, during his studies, has been an anatomist, anatomical tables are of singular use; they remind him of things which can be done, and of things which should be avoided; they correct the errors of time and forgetfulness; they remind him of all that he had once known, and bring to his perfect recollection the manner in which he had formerly dissected those parts in the dead body, which he is now to approach in his actual operation; they give him steadiness and confidence, and without such a monitor the best anatomist might be at a loss. Under the most perfect conviction of the importance of such a book, I have long meditated a neat small set of tables, with simple explanations, such as might serve to remind a well educated surgeon of the principal arteries of the human body. One painful confession indeed remains, I have promised such a book too long, it is four years since it was announced; but I have now devolved the task on my Brother, who will do justice to my idea, and make a book which will need no commendation. It is a desideratum in our profession and will be anxiously expected; no surgeon, I believe, will choose to be without such a book; my only anxiety is lest it should be still delayed.

DISCOURSE XI.

OF THE ANEURISM FROM ANASTOMOSIS.

THAT kind of aneurism which I venture to name Aneurism from Anastomosis, resembles those bloody tumors which appear in new-born children, occupying chiefly the lips, cheeks, eyelids, or hairy scalp, and which grow in process of time to an important size, bursting at last, and bleeding furiously, so as to oblige us to cut them out.

The disease which I am now about to describe arises, not from any such natural deformity, but from various and hidden causes; it often begins in adults, increasing from a trivial pimple-like speck, to a formidable disease. This aneurism consists in a mutual enlargement of the smaller arteries and veins. I should call it cutaneous aneurism, were it confined to the skin, or aneurism of the hairy scalp if it were peculiar to that part; but it is an accident which affects indifferently all parts of the body, and brings on complicated diseases even among the viscera, not less frequently than on the surface of the body.

This tumor, which I call Aneurism by Anastomosis, is a perfect aneurism. It arises from some accidental cause; is marked by a perpetual throbbing; grows slowly, but incontrollably; and is rather irritated than checked by compression. The tumor has only a sort of trembling or indistinct throbbing at first, but when it is fully formed, it has a continual, distinct pulsation; it beats strongly upon every occasional exertion; it swells up in spring and summer with a fuller and more active pulsation; it beats powerful in the time of menstruation; and by the incessant pulsation and occasional turgescence, it forms among the cellular substance, or among the dilated veins, sacs of blood. These little sacs form apices and tender points, which become livid and very thin, and burst from time to time, and then, like other aneurisms, this aneurism pours out its blood so profusely, as to reduce the patient to extreme weakness.

If the patient seldom die of this disease, it is, because the aneurism being seated usually in the skin, and being tender on its surface, these hæmorrhagies are foreseen, and easily controuled. But to what extremity of weakness the patient may be reduced by these successive hæmorrhagies, I shall presently explain.

I believe I speak modestly enough when I affirm, that this disease has been far too little noticed. It presents itself everywhere in an infinite variety of forms; the surgeon, not aware of its nature, performs only very imperfect operations; he makes partial incisions, his patient bleeds profusely, he is confounded with the unusual appearance of innumerable arteries, small, indeed, but bleeding with intense impetuosity, which nothing but a firm compress can stop. A firm compress is accordingly applied, the hæmorrhagy is repressed, the aneurism closes and heals again; again it begins its pulsations, distends, and bursts, and bleeds from month to month! the patient is exhausted with loss of blood, till at length his constitution and health are in danger of being entirely destroyed.

When from fear or ignorance we perform such partial incisions, we soon find ourselves in danger from its former nature; "We've scotched the snake, not killed, and it will join and be itself again." The return of such a disease (though doubtless the fault of the surgeon) is the reason why such a tumor is often most unhappily pronounced a cancer! an incurable disease!

It is not without reluctance and diffidence that I venture to use a new name, and a hypothetical one, yet I know of no word by which I can truly express the character of this tumor, except by this word ANEURISM FROM ANASTOMOSIS. I have cut round about such tumors in the living body, and dissected them out; I have seen others cut into the substance of those tumors in the way of operation, thinking perhaps to obliterate some dilated veins or some particular artery; and finally, I have dissected and observed such tumors after they were extirpated, and cannot be entirely mistaken in regard to their nature. The tumor is a congeries of active vessels, and the cellular substance through which these vessels are expanded, resembles the cellular part of the penis, the gills of a turkey cock, or the substances of the placenta, spleen, or womb. It is apparently a very simple structure that enables those parts (the womb, the penis, the spleen), to perform their functions, and it is a very slight change of organization that forms this disease. The tumor is a congeries of small and active arteries, absorbing veins, and intermediate cells. The irritated and incessant action of the arteries fills the cells with blood, from these cells it is re-absorbed by the veins, the extremities of the veins

themselves perhaps dilate into this cellular form. There seems to be a perpetual circulation of blood, for there is an incessant pulsation; the tumor is permanent, but its occasional variation of bulk is singular; it swells like the penis in erection, or the gills of a turkey cock in passion; it is puffed up by exercise, drinking, or emotions of the mind; it is filled and distended with blood upon any occasion, which quickens the circulation, as by venery, menstruation, the pleasures of the table, heated rooms, or the warmth of the bed. This tumor beats continually, increases slowly, its surface bursts, it bleeds from time to time; its pulsation and hæmorrhagies give it a title to rank with aneurisms, and its internal structure is such, that I may venture to name it, Aneurism from the Dilatation of Anastomosing Vessels.

I find that the vessels in this disease seem to increase in number by increasing in size; large arteries are, as it were, generated in parts where they were not known in the healthy state. When this continued and irritated action of the vessels is once fairly begun, the tumor works for itself, the circulation being occasionally highly excited, while each paroxysm of excited action not only enlarges the tumor for the time, but causes a permanent enlargement. Every active artery encourages, supports, and urges on another to increased action, and multiplies the sources from which the cells and vessels of this mixed aneurism draw their blood! It is the frequent communication and anastomosis of vessels one with another that makes every inosculating branch tributary to this active group of vessels.

Such is the influence of the anastomosis, or communication of vessels, in generating, supporting, feeding, augmenting, this tumor, that I know of no name so proper as this of ANEURISM BY ANASTOMOSIS, to express its nature: Nor indeed can any thing in the structure or economy of the vascular system account for the peculiarities of this tumor, its regular increase, its impetuous bleeding, or its intense pulsations, but this, that it receives the force, not of one or two principal arteries which lead towards it, but of innumerable small branches into which those larger arteries are divided, and which in their turn inosculate with other arteries still smaller and more distant, so as to bring in blood from all sides, and to possess infinite sources of blood. The activity of the group of vessels in the centre constitutes the main disease, and though you interrupt by ligature, all the more conspicuous branches which lead to it, that central group, while it continues active, will have blood.

This aneurism, in its beginning, is extremely small, it is a mere speck of disease; but it is a portentous one. I have reason to believe that it sometimes originates from so slight a cause as a tight hat or a trifling bruise; it frequently begins in adults, in pure, hale, and sound skin, where no spot, nor mark, nor tendency to disease, had ever been observed. The marks which children are born with are often superficial stain-like spots, which never change, except that their colour becomes occasionally deeper. But sometimes those spots are also defects in the substance of the skin, they are a species of aneurism, or they create a tendency to this disease; and from almost imperceptible stain-like spots, not elevated above the surface of the skin, they grow to dangerous bloody tumors, which require extirpation.

In both diseases, viz. of connate aneurisms appearing, when the child is born, in the form of a small livid tubercle! and of those forming spontaneously or arising from a blow, the process of their growth and increase is the same. When a set of cutaneous vessels first enter into this diseased action, a few of the extreme arteries in the skin itself are originally in fault, and commence an increased action, which draws the arteries of all the adjoining parts into sympathy with them; the arteries behind them convey more blood and push it on rapidly; these larger arteries begin to feed the disease, while the central group thus supported by the arteries behind, acts powerfully, the tumor begins its pulsations, and, like a punctum saliens, forms vessels as it were, by enlarging those small branches which were not visible before. The little arteries work powerfully and are dilated, the corresponding veins are proportionably enlarged, the number and activity of those arteries and veins are slowly increased. This increased circulation solicits more blood towards the tumor; and while the central branches impel their blood with greater rapidity, the trunks they come from, follow up that action and work so as to keep them full. It is thus that the small arteries work upon their corresponding veins, the trunks in their turn work upon those smaller arteries; action follows action, and indeed it were as impossible for the arteries of a part to act powerfully without drawing into consent and sympathy all the adjoining vessels, as for the heart to be enlarged in disease without a corresponding enlargement of the great veins through which it draws its blood.

Thus we have reason to believe, that the doctrine of derivation and revulsion is not so great a blunder in physics as was once supposed. It is true even in a system of rigid tubes; but its influence in the active arteries of a living body is

very great. Wherever increased action and quick circulation begin, blood will follow; and wherever the circulation is thus hurried and irritated, the vessels, and the cellular substance surrounding the vessels, will enlarge. This is the reason why menstruation, passion, wine, and other excitements have such influence over those tumors; and it is the reason why the increase of such tumors is as sure and uniform as the regular growth of the body. This is the reason why, when in the scalp (where many arteries of equal size inosculate very freely) any tumor of this kind begins, the disease spreads from artery to artery till the whole scalp is studded over with small aneurismal tumors, throbbing and enlarging till the surface of the scalp is as irregular as that of an aneurismal limb, and its substance like a pulp of extravasated blood *.

In women, the phenomena of these tumors are very remarkable; the hæmorrhagy from them usurps the place of menstruation, the action of their vessels is as regularly periodical as that of the arteries of the womb. The state of menstruation is a state of general excitement, and the particular action may be turned off towards any set of vessels, as those of the stomach, nostrils, or lungs. The excitement of menstruation affects the breasts, it is felt through the whole system, its effect on every tumor is remarkable! and I am daily provoked at seeing cancers, even of the breast, (which is always peculiarly affected), and other tumors which actually rise and fall with each menstruation, extirpated without the smallest regard to the menstrual period, though the change at such a time upon every tumor is such as the most ignorant observer might remark. The disease which I am now explaining, this aneurism from anastomosis, consists in the increased

* We had a patient in our hospital whose head was covered from the brow to the neck with a succession of aneurisms, smaller and larger, some like beads, and some very large. Schenkius relates such a case in the following terms:

CAPITIS ARTERIÆ, A VERTICE AD OCCIPITIUM USQUE CUIDAM IN TANTUM DILATATÆ INTUMUERUNT, UT
VARICUM SPECIEM REPRÆSENTARENT.

Intumescunt interdum arteriæ, et fiunt in illis veluti varices, quod tamen raro accidit: nam ob duplicem tunicam, quam duriores habent et crassiores, et ob sanguinem tenuem, quem continent, renituntur, et non ita facile dilatantur. Vidimus tamen Alexandrum Boscollum, civem Florentinum, cui ARTERIÆ CAPITIS A VERTICE AD OCCIPITIUM ADEO TUMIDÆ ERANT, ut viderentur varices in gentes: pulsabant autem vehementer cum tangebantur. Venit hic pīsas ut curaretur à Gabriele Falloppio: qui magno cum apparatu sectionem pollitus, cum manum jam inciperet admove, perterritus magnitudine tumoris curatione superfed: veritus ne homo vitam cum sanguine redderet ille autem cum ejusmodi defectu diu vixit. Vide Vidus Vidius, Part II. sectio 2. lib. 6. cap. 14. Medicinæ.



ANEURISM of the FORE-HEAD.

M^r R — page, 461.

J. Ball del.

D. Lizars. Sculp.

action of certain arteries; and the menstrual excitement, and the local action coinciding, cause periodical pulsations, periodical enlargements of the tumor, periodical hæmorrhages, and a bursting of the tumor at each menstruation, which alternations I have known continue for many years.

Thus I find it necessary to appeal to that doctrine of inosculations which I have formerly delivered. I am persuaded that you will feel the necessity of some theory to connect in your own mind the phenomena of this disease, whose anomalies are such as must be left to your own ingenuity to explain. I have endeavoured to settle the character and distinction of this singular species of aneurism, and after having initiated you into the theory of this disease, I shall proceed to relate, in the first place, a pure unencumbered case.

Mr. R—n, a young gentleman of about twenty-five years of age, had an aneurismal tumor upon his forehead, which had been growing for seven years. It began with a small spot like a pimple, of the size of a pea, and was, when he consulted me, of the size of an egg; there passed along the centre of the tumor the scar of an operation which had been performed about a year before. Nothing could be more singular than the circumscribed form, strong pulsation, and various peculiarities of this aneurism. Nearly seven years before, he had first observed a small pimple-like tubercle rise on his forehead (which had hitherto been smooth and sound), which was seated close upon the eyebrow, and was so small and so little troublesome, that he believed it to be a pimple merely, ascribed it to the tightness of his hat, and disregarded it for some time. When he consulted a physician of very excellent abilities, Dr. Cleghorn of Glasgow, that gentleman ordered gentle physic, and other trivial prescriptions, in perfect confidence that it would disappear; for at this time it was of the same colour with the rest of the skin, had no character of aneurism, and was so little troublesome, that it was for a long while after entirely disregarded. But when it had attained to the size of a sparrow's egg, he thought he felt pulsation in it at times, he began to be alarmed; and when at last he resolved to consult a surgeon, the pulsation was manifest, the surgeon recognized it as an aneurism, and advised that it should be cut out, but not with that earnestness which is necessary to persuade a patient, who seldom has at first a serious impression of the nature or consequences of such a disease. Mr. R—n advised, or rather talked, with others, but in so careless a way, that he began to be himself indifferent about the tumor, was easily prevailed upon to believe that if it increased at all, it must be very slowly; this little tumor seemed at first to

have arisen merely from a tight hat, and he was easily persuaded to hope that it would go away.

One gentleman directed him to try compression, and accordingly, a plate of lead was bound firmly down upon the tumor; he suffered the pain of this pressure with great constancy for some days, and for several weeks he continued a less painful degree of pressure; but finding the aneurism beating more powerfully, foreseeing no good effect, and irritated with the constant and ineffectual trouble of supporting the pressure, he threw away the bandage, and let the aneurism grow as it pleased. This was about seven years ago; during five years had his tumor continued to grow, when the nature of it being no longer equivocal, and the consequence of allowing it to increase, much to be feared, it was resolved to perform the operation. There is every apology for the theory which the surgeon had imagined of this tumor, for its form was very singular. It was seated immediately over the eyebrow, and was about the size of a small egg; it lay exactly in the course of the frontal artery. The small orbital artery was found entering into the lower end of this oval tumor, while a branch of the temporal artery, remarkably enlarged and tortuous, went curling along the temple and passed also into the upper end of the tumor. No other vessels, neither arteries nor veins, could be traced to it, but these two arteries, and the intermediate tumor beat in concert; the arteries beat much more powerfully than in their natural state, and the tumor had a very powerful throbbing. This tumor, which became turgid whenever the pulses beat strong, seemed to be merely an enlargement of the frontal artery, (vid. fig. 1. p. 465.) and under this apprehension was the operation arranged as follows: The surgeon first made an incision in the lower part of the tumor, and passed a ligature under the orbital or frontal artery; but when he had tied this artery the pulse of the aneurism was nothing abated. He next made an incision along the temporal branch, where it ran into the upper part of the tumor, and tied it also with a ligature, but in vain; the pulsation of the tumor was still unaffected. It was then necessary to operate upon the tumor itself; it was opened its whole length, and bled very profusely; one ligature only was used, that ligature was struck with the needle into the centre of the tumor, where there was one artery larger than the rest; but from all the surface besides there was one continual gush of blood; the hæmorrhagy was repressed, and the wound bound up with a compress and bandage. The tumor in short was thoroughly cut open, but it was not cut out. It healed slowly, the ligature came away with difficulty; after a fortnight

the patient was left to dress the wound himself; he felt distinctly, before the wound was healed, that the pulsation had begun again; the pulsation became very strong, and the tumor, by the time the wound was actually healed, had attained the full size it had before the operation; it was indeed rather larger than before.

But it might easily have been perceived, that this could not be a mere dilatation of the frontal artery, for the tumor was some thousand times the diameter of that artery. The pressing the point of the finger upon both arteries stopped their pulsation, but did not in the slightest degree affect the tumor; and since the striking a needle and ligature under each artery, did not affect the pulse of the aneurism, it was plain that the tumor was of such a nature, as to draw its blood from a variety of sources, and that it was necessary, not to cut it open, but to cut it out.

For nine months longer the tumor was suffered to grow unmolested. When Mr. R—— first desired my advice, the character of the tumor was very strongly marked.

It was very protuberant from the forehead, of a regular oval form, about the size of a small hen's egg. The scar of the former operation, about three inches long, ran across the centre of the tumor. The tumor was not purple on its surface, like the flesh spots of children, it was covered with a firm and sound skin; the scar was white, the rest of the skin was of a deep red, from inflammation, and not from the blood appearing through it; its throbbing was exceedingly strong, and of late it had become very painful, so that he was in fear of the bursting of the tumor, or the corruption of the bone; it was from the pain, which had of late been considerable, that he was inclined to ask advice, or to submit to a second incision. The notes taken at this period, in relation to the appearance, size, and pulsation of the tumor, are as follows:

The lower artery, the ocular, which comes from within the orbit, is very large, and is felt entering into the lower corner of the tumor; the temporal branch is very greatly enlarged, is remarkably tortuous, pulsates with great force, so that I am surprised it has not wrought out other aneurisms near this first one. He wears his hat quite off his face; when his hat presses upon the tumor, it increases in size. When he runs, when he is heated, when he stoops, when he breathes hard, it increases in size, and its pulsations are very strong: When he drinks spirits or wine, it swells, pulsates, assumes a deeper tinge, and every person at table can perceive the change; and when I handle it rudely, it swells up,

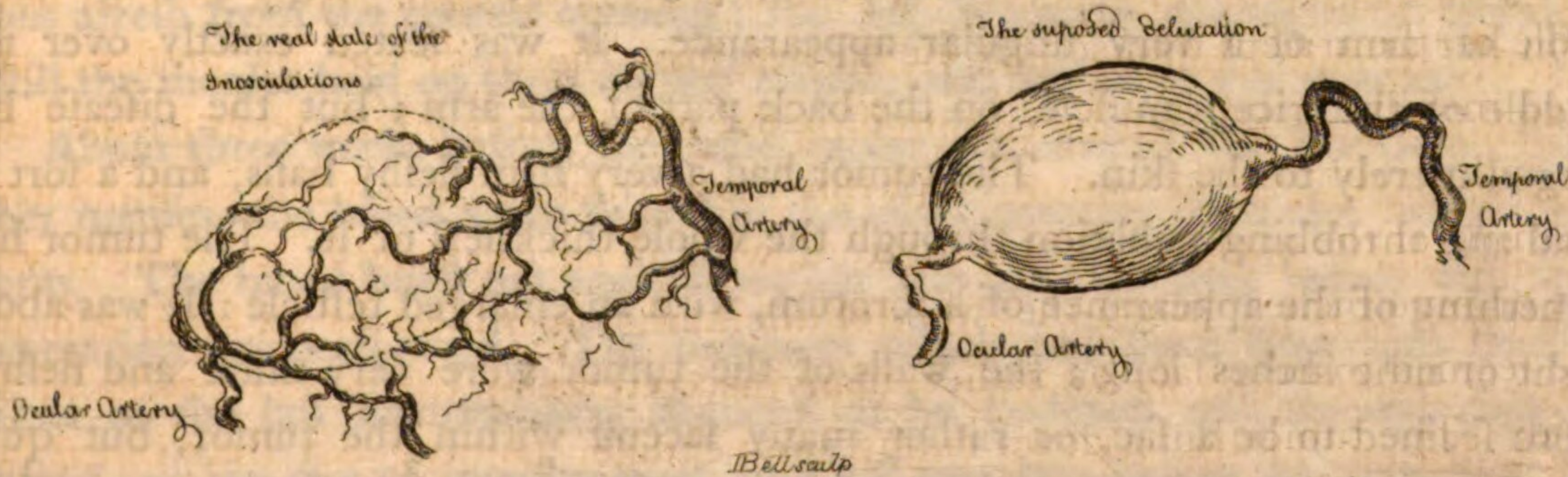
and when he chooses to retain his breath, it is inflated like the gills of a turkey cock. It is only for ten days that the throbbing pain has been remarkable, but that pain increases, and as it runs backwards along the course of the artery, it is, by compressing the artery, in some slight degree relieved.

The nature of this aneurism is expressed in the second figure of the marginal plate, page 465. where (a) marks the ocular artery; (b) the dilated and tortuous branch of the temporal artery; and (c) marks the manner in which those arteries spread before they enter the tumor; while (d d) mark the Anastomosis with various other branches. Were this aneurism a mere dilatation of one artery, it should be emptied at once by compression, and the continuing of that pressure, should prevent its being filled again. But when it is compressed firmly, it yields very gradually, as if the veins received its blood; the compressing of its two great arteries, does not prevent its filling again; you are able to suppress their pulsation, but the aneurism still pulsates, it throbs from the bottom, it rises very gradually when you cease from pressing, and soon fills to its full size; it seems to receive its blood from one knows not what sources, from small arteries which cannot be perceived. The sudden inflation of this tumor, like the gills of a turkey cock, its various fulness, according to the season of the year, its falling in autumn when the blood is low, and its rising in the spring when the circulation is rapid, the variations of it in respect of fulness, and its colour varying according to the degree of turgescence, its sudden puffing up upon taking wine or using exercise, its slow subsiding, and yielding in some slight degree by pressure, and its being so little affected by compressing the great artery which feeds it, are sufficient indications of its nature. All this proves, that it is a tissue of small arteries and veins, it fills not like a varix, slowly, there is, indeed, no dilated vein to be seen near it; its filling is by distinct throbs, it is filled by its small and numerous arteries, and its swelling is (like the erection of the penis) produced by the pulsations of the arteries, stroke after stroke, pouring out their blood into the cells.

With this view of its nature, I was sure that it was a kind of tumor which was not to be cut open, but to be cut out. Dr. Jeffrey, and Mr. Cooper surgeon in Glasgow, had the goodness to assist me. I tied this rampant temporal artery before touching the tumor, that it might be once more ascertained how little this interruption of any one artery could affect such a tumor. The pulsation of the tumor was nothing affected; I knew by this what sort of an enemy I had to deal

with ; I knew, that if I cut within the active circle of this tumor, I should have innumerable branchings of the artery to tie up ; but that if I cut wide where the arteries were undivided, and before they had formed their anastomosis, I should have to deal with but one or two. I disregarded the bleeding, I knew that I had no means of saving blood but by making the operation rapid. I made an oval incision which comprehended about a fourth part of the surface of the tumor ; dissected the skin of each side down from it rapidly ; I went down to the root of the tumor, and turned it out from the bone. The tumor was a perfect cellular mass, like a piece of sponge soaked in blood ; it was tolerably solid, and dissected out very clean, in the form of a regular tumor ; it bled furiously during the operation (that I had resolved to disregard), but the moment the tumor was turned out, there was not one drop of blood, the surface was clean, the pericranium quite bloodless, the lower artery stood wagging out of its hole in the orbit, and I held it with the hook while Dr. Jeffrey tied it. The upper tortuous artery was also tied ; the eyebrow, which was divided exactly in the middle, was brought nicely together, the incision healed in ten days ; the wound has been now two years healed, and the scar is small, reddish, and very little perceptible, and the two extremities of the eyebrow, which were two inches distant in the time of the operation, are perfectly close.

Plans of the Aneurism of the Forehead



But there are varieties of this disease, which nothing but a variety of cases can explain ; and one consideration should give us a particular interest in investigating its nature ; that if neglected, it becomes incurable, and when it is incurable, I think it cannot fail to be in time fatal. It becomes incurable, when having been operated upon with a partial incision, instead of being extirpated, it is but irritated, and grows till it spreads its roots among the adjacent parts. It becomes

incurable when it occupies a great extent of skin : It is an incurable disease when it affects any of the viscera. One phenomenon of this disease, I think, is very remarkable ; often in the course of this disease various sacs are formed, which receive sometimes serum and sometimes blood, according to the state of the tumor, so that tumors of this kind sometimes burst like a ganglion or great salivary tumor, discharging a thin serum like saliva. There is also another singularity, that always, in women, the rising and falling of this kind of tumor has a curious connection with the menses, and the regular and monthly hæmorrhagy, from this tumor, frequently supercedes the menstrual discharge.

This kind of aneurism sometimes grows in the limbs, and to a very remarkable size ; bleeds profusely, and reduces the person to extreme weakness, and yet is easily cured ; for the rule which I have laid down, gives you a perfect command of this aneurism. You must not cut into it, but cut it out. If you merely cut into it, the hæmorrhagy is terrible, and the cure imperfect ; if you cut round it, and at a little distance from its root, in place of the profuse hæmorrhagy, from numberless arteries, you have but a slight bleeding from one or two, which are extremely small.

A tumor of this kind, which had grown to a remarkable size, and done infinite injury to the constitution of the patient, was extirpated by my friend Mr. Harkness. The history of it is as follows :

“ Jean Smith, a house servant, about thirty-nine years of age, had a tumor upon her arm of a very singular appearance. It was seated exactly over the middle of the triceps muscle, on the back part of the arm ; but the disease belonged merely to the skin. The tumor had a very firm fleshy basis, and a sort of dead and throbbing pulsation through the whole thickness of it. The tumor had something of the appearance of a scrotum, with an enlarged testicle : It was about eight or nine inches long ; the walls of the tumor were very thick and fleshy ; there seemed to be a sac, or rather many sacculi within the tumor, but quite flaccid. The tumor hung down flabby and pendulous ; it was of a livid colour, as if it contained blood, or the remains of blood ; where it was not blue like a vein, it was mottled of a deep red, or lakey colour. This tumor had burst often and poured out prodigious quantities of blood, and at the place where it had burst, and especially at one point, where the blood had always of late been poured out, the surface of the tumor was covered with thick white scabs, as if the bleeding orifices had been plastered up.

The history of the tumor was singular. It was about eighteen months before, that there had appeared a small purple spot upon the back of the arm, which soon grew into a tumor. The tumor enlarged slowly, and had, in the course of five months, attained to the size of a hen's egg; then, for the first time, it burst and discharged a great quantity of blood. The blood was red and florid, and thrown out with great impetus; but it stopped of its own accord. It increased in size from this time forward very rapidly, and in four days more it was thought necessary, by the surgeon in the country, to open the tumor. This was done by incision; there had been a sac formed, even at this time, a great quantity of coagulated blood was taken out, the hæmorrhage was very profuse, from the whole surface, but no particular artery was seen. No vessel great or small was taken up, the hæmorrhagy was stopped with flour, firm compresses, and bandage. The wound was healed, the tumor grew, and from the size of a hen's egg, it increased in a few months to its present dimensions, of eight or nine inches in length, and six or seven in breadth.

But this incision never healed entirely; a succession of scabs formed upon that part of the tumor, and from time to time the blood burst out from it on the slightest accident or injury, and most infallibly the hæmorrhagy returned at every menstruation.

Her menses continued regular; at every menstrual period she was sensible of a heat, pulsation, and swelling in the tumor; at each menstruation, blood burst out afresh from the central opening; she lost immense quantities of blood, but still the menses held on their regular course, and flowed in due quantity.

About three weeks before she came under the care of Mr. Harkness, she had her menses, the blood again flowed in the usual quantity from the tumor in her arm. The blood burst out again from her arm just two days before this second operation was performed. The bandages which had been kept firm from the time of the last hæmorrhagy, chanced to be loosened and thrown aside; the blood, on the day of menstruation, and just two days before the operation, burst out impetuously, and she lost no less than four pounds of blood*.

OPERATION.—This hæmorrhagy was so dangerous, and implied also something so peculiar in the nature of the tumor, that Mr. Harkness very prudently called together a full consultation, especially of the older surgeons. The tourniquet

* At this time she had begun to have considerable pain in her arm.

was applied, the foul cloths and tight bandages were taken away from the tumor. It hung like a thick and massy bag half empty. Mr. Harkness did not set about the operation without a degree of apprehension, nor were the gentlemen who were convened to see the operation without fear of a very troublesome hæmorrhage. Mr. Harkness went round the base of the tumor with two strokes of his knife; he separated the tumor very rapidly; when the tourniquet was slackened, there was not the smallest hæmorrhage; the place where the tumor had been, remained almost clean of blood; one small artery bled smartly, and was taken up with the tenaculum. Those who had seen the alarming hæmorrhagy of the preceding day, were astonished, while those who saw the tumor for the first time, and had been called together as to an important case, were almost offended to find themselves so formally summoned to attend on an occasion of so little danger*.

A tumor in a part like this, though imperfectly cut, is still curable; had it extended itself, even along the whole arm, it might still have been cut away. But a tumor of this nature, seated on the head, or about the jaws, and mangled with an imperfect incision, becomes exceedingly dangerous; it is long before a person who has submitted himself to an unsuccessful operation, will expose himself to another attempt, which, in particular circumstances, is not altogether safe.

Mr. N— had a child born to him at the full time, very strong and healthy, but with a small dimple or spot upon the right temple, of a livid colour, flat, more like a stain than a tumor. It was about the size of a sixpence, and totally void of pulsation. But this portentuous spot, when the child was about a twelvemonth old, began to change its nature. It rose more prominent in the centre, it was like a small berry, purple, soft, and very tender; and upon the slightest touch it would bleed, not like a fretted sore, but very profusely like a vein. Even the ruffling of his nightcap burst the tumor; the parents were kept in unceasing alarm, lest (as often happened) it should burst during the night and bleed the child to death. They watched him with incessant care, and had a compress and bandage, with a piece of lead in it always ready, and with which they repressed the bleeding.

The child was about a year old when the tumor began to bleed, and the pul-

* Upon dissecting this tumor, I find it like a placenta, stringy, cellular, consisting of a confused tissue of small arteries, veins, and cellular substance, like the substance of the placenta or of the womb.



ANEURISM of the BOY. N.

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J. Bell del.

W. Archibald Sc.

sation began in it about the same time ; and when he laughed, or cried, or coughed, or struggled with his feet and hands, the tumor suddenly puffed up with a perceptible motion. At such times, the slightest touch made it bleed, and in the moment of bursting out, the blood flowed in a full stream, which often darted to the distance of a yard.

This state of anxiety the parents endured patiently for four years, when the tumor was greatly extended ; it now covered two inches or more of his temple ; the pulsations, when the boy was vexed or heated with exercise, were very strong, and the bleedings were frequent and very profuse ; so that the child was at times quite blanched with the loss of blood. But he was now grown up to strength, and they resolved to submit their child to an operation, not to remove a deformity, but really to save his life.

A surgeon of very considerable knowledge in his profession, performed this operation ; I assisted him, and had an opportunity of seeing the nature of this tumor, and the effect of cutting into its substance. The appearance was very singular indeed. A sufficient number of needles, tenaculums, and hare-lip pins were provided, not one of which, can in any such operation, be of the smallest use. The incision was made directly along the middle of the tumor ; the first incision was accompanied with a gush of blood, as if a bag of blood ten times the size of this tumor had been cut into. The blood continued to rush out impetuously ; we were all covered with it, and the child struggled very violently. The operator then cut down into the centre of the tumor ; he cut quite down to the bone, hoping to come at some great vessels which fed the aneurism, and the two sides of the tumor were now held apart with hooks and forceps to let him use his needles. The appearance was very singular, and must have been very confounding to a person who began the operation with any hopes of finding one or more remarkable arteries. For, although the tumor, before the operation, was easily flattened, as if it had been a mere dilated vein or some sac of blood, there was in truth no sac, great nor small ; the whole substance of the tumor (even in its very centre, and under the point where it was most particularly livid and thin) was perfectly cellular. The substance of it was cellular, stringy, and expressly resembling the corpora cavernosa penis ; it was uniformly cellular, and singularly firm ; those cells were filled with blood from the arteries, the arteries entered into the tumor in all directions, so that no pressure could command them, and the little arteries being all cut directly across in the centre of the tumor bled each of them from both

ends; seven or eight small arteries bled from the opposite sides of the tumor; the streams of blood, which were very smart, crossed and intersected each other in every direction; the arteries bled absolutely like the spout of a watering-pan, while the dark and dense blood of the veins run in a full stream down the face, choking the boy while we held his head firm upon the pillow.

The needle was struck under one of the largest arterial mouths, but without effect; it was now easy to foresee that ligatures could be of no service, the corner of a sponge being cut into a proper shape, was thrust down into the incision, and supported with compresses, and fixed with a bandage. There was some reason to hope (though very slight indeed) that a tumor which had been so thoroughly opened, might be gradually destroyed by caustics. The gentleman who performed the operation, continued for many weeks to use, in various ways, the caustics, compresses, sponges, and the bandage, but all in vain; the tumor, even before it was healed, had acquired its former size, and the moment the bandages were relaxed, it swelled again. While they were continually occupied with the cure of the fore, and applied the bandages night and day, the aneurism was no doubt prevented from bleeding; but no sooner was the boy allowed to go to play with his companions and little brothers, than it burst out again, it bled now as profusely as ever; many a time they were alarmed for his life, the bloody scenes that passed for two or three years were very distressing to the parents.

This boy is now ten years of age, of a fair complexion, healthy and active; the hæmorrhages are less frequent, he has lost no blood for these three months, and his father is flattered with the hopes of the disease changing when he comes to a certain time of life; but this cannot happen! the tumor is increasing so much, that it now covers four inches of his cheek; it is widening its basis, and the basis is growing more and more solid. When the boy runs, cries, or laughs, it rises very high, beats so as to be seen at a considerable distance; and he says, that when the master leaves the school for a moment, and the boys make a noise, it beats terribly, and frightens him very much; and that when he is playing at hide-and-seek, it beats so that he is frightened at it!

In examining this aneurism, now at the distance of five years from the operation, I find the temporal artery, and the transverse artery of the face, enlarged, and running into the tumor at the upper part and sides; but upon putting my finger into his mouth, and feeling the whole thickness of the cheek, I am not sensible of any remarkable artery entering from that side. When I press the tu-

mor with the palm of the hand, I find that I can flatten it almost entirely ; it is repressed by slow degrees, it rises again very slowly ; but before you can count two hundred it has risen to its stationary size. It is only when I tickle his sides, and make him laugh immoderately, that I can see it of its full size, or perceive its pulsation. This boy's aneurism is manageable still, but, in a little while I fear it will cease to be so ; and when puberty arrives, I am apprehensive there will be a very unfavourable change.

When such tumor is seated among the viscera, or in any inaccessible part, it must be an incurable, and in the end a fatal disease.

“ A young woman about twenty-five years of age, who was bred a milliner, lived a sober, quiet, industrious life, and is now married to a young man, a carpenter, of respectable character. When she was about nineteen years of age, she had the influenza, and felt all the weakness and languor which succeeds that disease. But it left behind it a more lasting malady ; for soon after the influenza was gone, she began to feel a degree of uneasiness towards the rectum ; then she became sensible of a tumor ; and when it was first examined with the finger from the vagina (for this tumor lies in the middle betwixt the rectum and the vagina), it was about the size of an egg, soft, puffy-like, yielding like dough to the finger, and having a very sensible pulsation.”

“ This tumor seemed to grow very slowly, but the more she was obliged to conceal such a disease, the more was she alarmed ; she felt it beating within ! she was sensible of its being enlarged in sultry weather ! she was sensible of its being affected by menstruation ! she felt it beating very strongly when she got warm in bed ; it kept her awake with fear and anxiety, and its pulsation was at all times alarming. During its slow growth, it has given her little pain, except when going to stool ; for the fæces are always long delayed, and she passes them with difficulty ; she has been always costive, and often much pained.”

“ She was married about three-and-twenty years of age, i. e. about five years after the commencement of this disease. The growth of this aneurism had been hitherto extremely slow ; but when in the second year of her marriage, she fell with child, the midwife, who was early consulted on account of this alarming tumor, could observe a very sensible and rapid increase ! and in the moment of delivery, the tumor was pushed, in some degree, before the head of the child. As a first labour, her delivery was naturally slow, but the tumor had no share in causing this lingering labour ; it was partly compressed, partly protruded before

the head of the child, she was safely delivered, and the tumor retired again, and she recovered in the usual time, though the appearance of such a tumor greatly alarmed her midwife and friends."

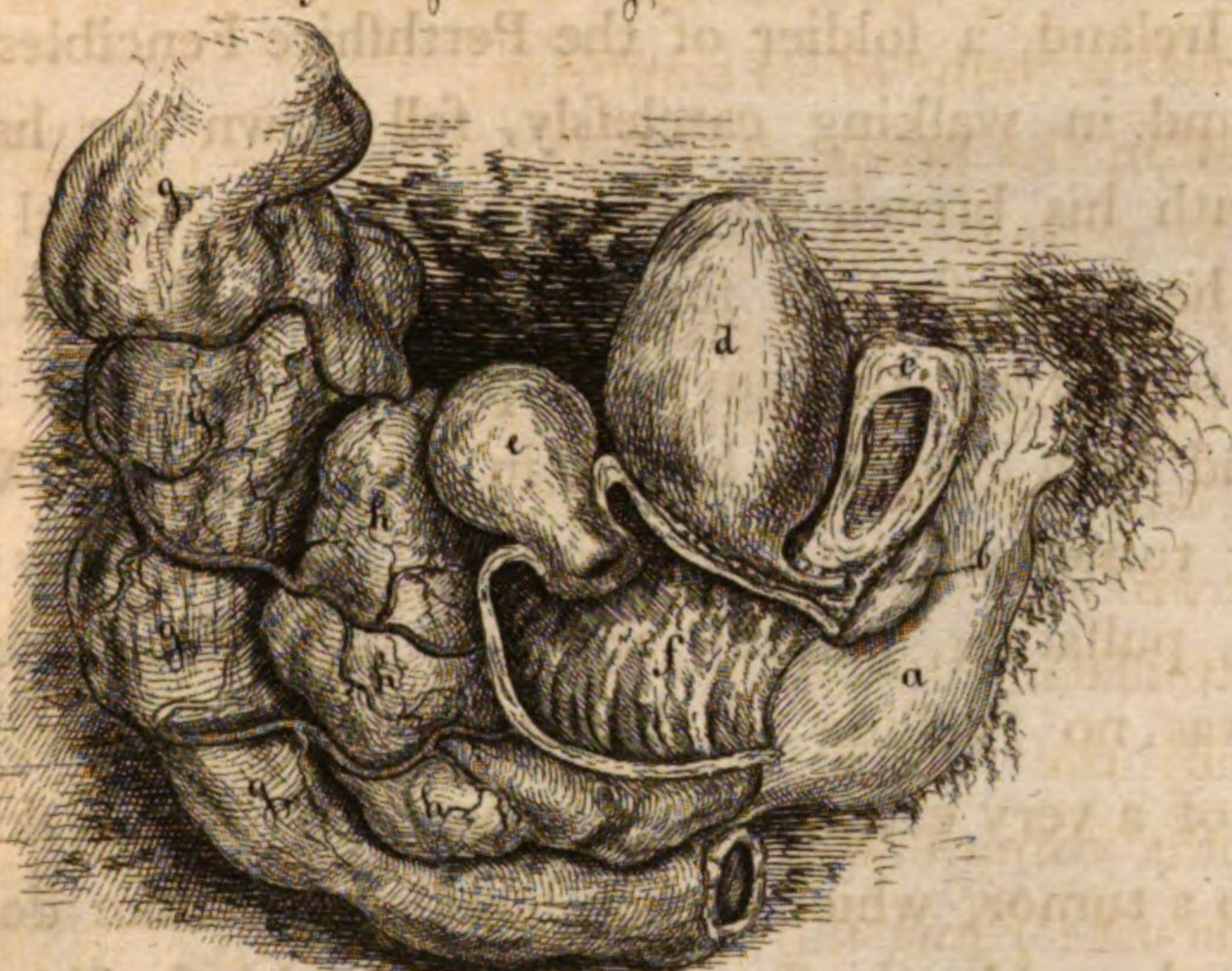
The tumor is plainly this aneurism by anastomosis. I have observed it in various states, and can give a very full account of its condition.

While this tumor lies still within the pelvis, it seems to belong to the walls of the rectum; it lies betwixt the rectum and vagina; but its chief bulk is towards the left side, where it lies broad and flat against the side of the pelvis, resting upon the branch of the os ischium. The firmest part of the tumor is felt towards the verge of the anus, and towards the left side of the rectum; upon introducing one finger into the rectum, and the other fore-finger into the vagina, the tumor is felt betwixt them, throbbing very powerfully; upon examining deliberately and long in the vagina, you can observe, that the whole of the tumor is in some degree compressible and soft; that it is throughout irregular, knobby, and glandular-like; but the knobs are not hard. In the interstices of those knobs, it feels soft and doughy; the soft parts allow you to press your finger deep betwixt the knobs; the knobs themselves are in some degree painful on being pressed. But while the head of the child was passing, the tumor could be seen, at least the lower part of it; and it seemed to range along, from the lower part of the labium to the left side of the anus, protruding the verge of the anus and the inner surface of the labium. The lower hæmorrhoidal arteries, and the great pudic arteries, are the chief vessels in this aneurism; but there are others of still more importance; for while you feel, by introducing the finger, a powerful general pulsation, you feel, by examining carefully with one finger, first, two or three long arteries, pretty large and tortuous, running along the walls of the rectum and vagina, towards the left side of the pelvis, and plunging into the substance of the tumor; and by pressing the finger deep betwixt the knobs, little arteries can be felt creeping betwixt the knobs.

The nature of this disease I need not now explain; the consequences of it, God knows! These notes of the state of the tumor I took five years ago; since then, she has had a second child, has had but poor health, is of late fallen very low; and her husband has called to beg that I would visit her, on account of continual heavy pain, want of rest, extreme weakness, and a hectic disposition; and now, partly from weakness, partly from low spirits, she lies almost continually in bed. I find the aneurism remarkably increased in size; but it is quite concealed

within the pelvis. Though none of the tumor projects, there is a general swelling of the labiæ and perinæum; and by laying your hand along this swelling,

a Labium b Nympha c Puls d Bladder
e Womb f Vagina g Rectum h the Tumor



J. Bell sculp.

you feel the pulsation very strongly from without. The long arteries which feed the tumor, and which I had planned in my note-book, I no longer feel; the increase of the tumor has raised those arteries higher in the pelvis, and carried them out of reach of the finger; but the smaller arteries creeping betwixt the several tubercles, I feel more distinctly than before.

We cannot now be at any loss to explain, what has hitherto appeared incredible, viz. the cases related by old authors, of the best credit, of pulsating spleens, the throbbing of whose arteries could be easily felt through the cartilages of the false ribs! Which of the viscera should be so liable to this disease as the spleen, where the most careful investigation of physiologists has discovered nothing except a rapid circulation of blood, for purposes which they have never been able to divine? In the spleen, there are large arteries and numerous veins, and intermediate cells perfectly regular, receiving and actually containing the blood; the structure of this organ is unlike that of any other part of the body, unless, indeed, it resemble that of the penis, or placenta, or of the pregnant womb, or this unnatural structure, this very disease which we are now describing. Tulpius describes a man's spleen as pulsating so strongly, that, like a violent palpitation of the heart, it could not only be felt, but heard. The patient was a poor labouring man; and Tulpius one day going to visit him, along with Henricus Salius, a physician, they both heard the pulsation of his spleen at the distance of thirty feet, and that so distinctly, that they could count the pulse as fairly by the ear as by the finger*.

* "Et quidem tam distincte: ut numeraverint non semel singula verbera, et admota manu etiam coram tetigerint, quoscunque, ferientis lienis, ictus.

This kind of aneurism is incurable, not in those cases alone where it is connected with internal parts, but also when, although occupying an external surface, it is of such extent, that no operation can be performed. Of this kind was the aneurism of a man, whose case I shall relate in few words.

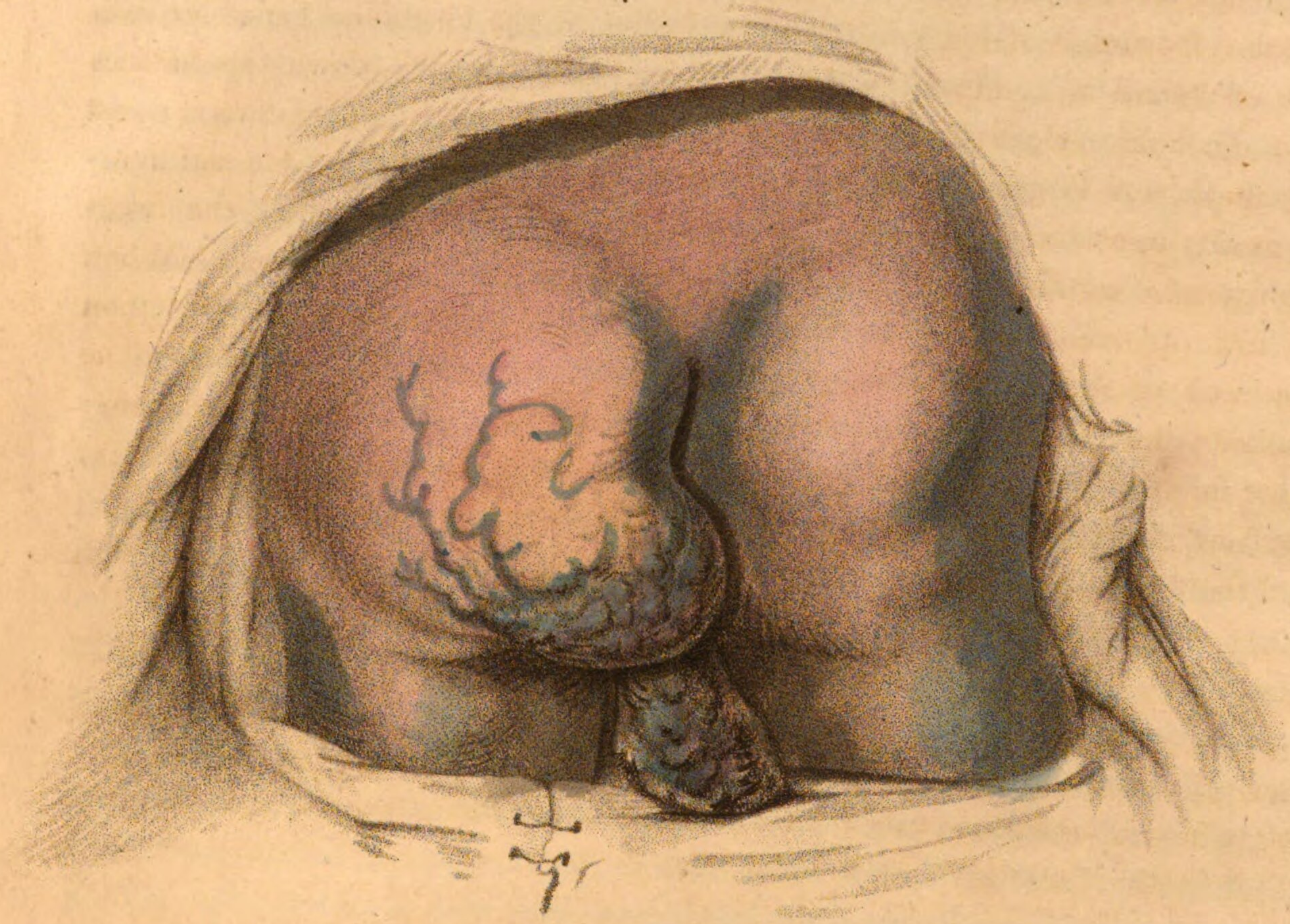
John Doring, a native of Ireland, a soldier of the Perthshire Fencibles, was put on board a transport, and in walking carelessly, fell down the hatches into the hold. He lighted with his breech on the gudgeon of a swivel; and the shock was so great, that he lay insensible for half an hour. He had lighted exactly upon the tuberosity of the left ischium; the parts swelled, the swelling extended to the testicle, and for a long time he was in great distress. When he first observed a particular tumor, it was circumscribed, seated exactly upon the knob of the left ischium, pulsating, painful, and very distressing when he walked; but at first there was no swelling of the veins. The tumor, after some months of growth, was of a very extraordinary appearance. The skin of the buttock was thickened into a tumor, which, when handled, felt like dough; and the skin of the scrotum, thickened by the same process, mixed insensibly with

“Quorum reciprocum sonitum, equidem memini, cum Henrico Salio Medico Ultrajectino, satis distincte audivisse, licet id temporis ab ipso recessissemus, ultra triginta pedes.” TULPIUS, p. 139.

That an enlarged and pulsating spleen is not inconsistent with the economy of the circulating system, has been just explained. If it should be thought rather surprising that every enlargement of this viscus does not pulsate, and that ague cakes do not appear in this form of pulsating spleens, let it be remembered how much the spleen is indurated in those cases, and its pulsation repressed by the additional quantity of matter, and by the scirrhus hardness which takes place. I have no doubt that the theory I have suggested, will be found fully as satisfactory in explaining the fact of a pulsating spleen, as that of Tulpius, who attributes the return of this man's ailments to fits of the atra-bilis, under which he laboured. “And the atra-bilis (says Tulpius), and the vital spirits, and the arterial blood, being obstructed! strive with one another! so as to move easily even the heavy and enlarged spleen, and make it beat against the ribs; all which we can very well understand, by the analogy of other confined spirits! what they can do, when opposed, may be easily imagined, from the examples of thunder! and cannons! and chestnuts roasting in the fire!”

If I reckoned it a matter of great importance to establish the fact of a pulsating spleen, I should neither give this translation nor the original of this curious piece of philosophy, which is not very honourable to Tulpius, or rather to the age he lived in. “Excitati itaque fuere hi ictus, cum a motu atræ bilis: tum a spiritu, sanguini arterioso, incluso. Quæ duo acquisivere tantum virium; ob prohibitam transpirationem; et adstrictam, arteriarum spleneticarum, obstructionem: ut potuerint non modo elevare, sed movere satis commode grave, ac induratum lienis corpus.”

“Virtus quippe unita multum potest. Exemplo sint, tonitru, tormenta bellica, *castanea carbonibus impressæ*. In quibus luce clarius apparet, quid valeat spiritus inclusus.”



ANEURISM of the HIP & SCROTUM
in
JOHN DORING.

J. Bell del.

J. Grant Sculp.

the tumor. The veins of the hip, which we never see in their natural condition, were very singularly dilated; and the enlarged state of the veins extended very high upon the buttock. The veins of the scrotum were also very singularly dilated, but there was no affection of the testicle itself. The parts were not in any degree painful when handled; the tumor was distressing only when he was obliged to walk, but there was a general pulsation through the whole substance of the tumor. He was a very rude fellow, had gone into the army with no intention of serving. There was, indeed, no motive in such a case for proposing any operation; but I was sensible that though there had, it would have been vain, he had other objects in view! he would not be cured!

Among the cases in which a neglected tumor of this kind has grown to a very remarkable size, I hardly remember any one more particular than the following.

Janet Tarbet, about twenty-five years of age, a poor woman, who lived far in the north country, had a tumor of this kind growing for twelve years, for which she had suffered one partial operation, which was of course unsuccessful. She was sensible of no cause to which this tumor might be ascribed; she was, indeed, in the lowest condition of life, and employed in the coarsest country work, but certainly received no blow. About twelve years before I saw her, she first perceived, upon the outside of the knee, not a tumor, but a spot or mark, flat, and of a purple colour, smooth as the rest of the skin, not painful in the slightest degree; it grew very slowly, and for a long time resembled one of those blue marks which are born with children; it became more and more livid as it increased in size; and though void of pain in general, it was painful when struck by accident, as against the corner of a chair, and the pulsating pain continued for a quarter of an hour. She was a reaper in two harvests, after this formidable tumor began; it was only after the labours of the second harvest, that she was sensible of the increase of the tumor. During the first harvest it increased slowly, but the labours of the second harvest excited the tumor so much, that it grew in a short time to the size of an egg.

Her condition before the first operation was performed (which was in the third year of the disease), was very singular. She had been all her life a poor, laborious creature, alternately spinning night and day, or working at the heaviest country work. When at any time she chanced, in working, to strike her knee against any thing, the tumor was excited, and began to rise and to beat very

strongly ; even the motion of the leg in spinning made it swell. When she went to any violent labour, the tumor puffed up ; it beat very strongly, and felt, she says, " as if it was a heart, or as, some living thing had been in it ;" at such times she was obliged to lay herself down upon the bed ; and after a quarter of an hour of quiet, the beating ceased, and the pain went off, for there was much pain when this beating began.

She was often a week without pain ; at other times the pain and beating returned daily, or frequently during the day, according to the work she had to do ; but the tumor was always singularly affected by the return of her courses. During the first fortnight after the menstrual evacuation, the tumor continued very low and flaccid ; the second fortnight it became full, and even turgid ; then it began to pulsate, and in the week preceding menstruation there was a turgescence and strong pulsation, which ceased the day the courses disappeared. During a long period her menstruation was profuse, and there were also terrible hæmorrhages from the tumor. These hæmorrhages were more frequent at the approach of menstruation ; they happened from the slightest accident, which broke the surface of the tumor ; she was used to command the torrent of blood, by bandaging the tumor very firmly, or, as she expressed it, by " hanking the part very hard with cloths or handkerchiefs." After each hæmorrhagy, whether from menstruation or from a blow, the tumor, which was livid and soft, healed up with a sort of scab ; and after every loss of blood, whether by menstruation or by direct hæmorrhage, she was reduced to a very low ebb ; and the tumor itself, which had been very blue, tense, and pulsating strongly, became pale and flaccid, and hung quite pendulous, as if it were a mere bag just emptied of its blood.

This is the whole description of the disease, which became in the third year of its growth the subject of an operation. It was flat and livid at first ; it soon began to bulge out, to throb, and to bleed ; it had grown by successive impulses to the size of an egg ; it was only after the labours of the second harvest, that it began to be very prominent in the time of its turgescence, or to be flaccid and bag-like when it was emptied of blood.

The pain, want of sleep, and inability to work, the frequent hæmorrhages, and the destruction of her health, and the effect which the pulsation of the tumor, when heated in bed, in harassing her mind, inclined her to call the surgeon, who ventured to strike a lancet into the tumor as a test of its nature ; the blood in-

stantly spouted out, as if he had opened a vein; it was closed with a compress of lint and a bandage. The next day the operation was performed; the tumor was extirpated, and a number of small arteries were tied.

After the operation she fell very low, became sick, feverish, and at last delirious; and when she recovered her senses, the tumor was manifestly increasing again, so that at the end of six weeks it was proposed to operate a second time, in order to cut out some small remains of the tumor; but she was now restored to her senses, found herself easy, saw no danger in the tumor, and absolutely refused to submit to another incision. For seven years she had continued wonderfully well, some remains only of the tumor appeared; the lower part of it hung down pendulous, by her account, like the auricle of the heart, and was more or less turgid, according to the state of her health, or of her menstruation, the season of the year, or the labours she engaged in; but she was hale and strong, and said she could match herself with any young person at work, and at all kinds of work.

In the ninth year of this disease the little pendulous flap began to grow again; it began to be affected by labour and menstruation, and upon the slightest accident it bled as at first; the pulsation became more perceptible at each menstruation, and at each menstruation the tumor received an increase of size. By the tenth year it was enlarged to the size of a twopenny loaf, and beat very violently; but it was only in the beginning of the eleventh year that it burst out again. This happened to her one evening when she was abroad at work. In a moment her stocking and shoe were filled with blood. Since the time of the operation (for eight years) she had worn a bandage, which she found necessary, both to repress the pulsation, and to moderate the pain; without it, indeed, she could not walk even the length of the door. This bandage did not resist the hæmorrhagy! she undid the bandage, crawled home, and applying cloths, and hanking it very hard, she at last suppressed the hæmorrhagy.

From this time the bleedings became frequent and irresistible. Often while she was, as she expresses it, "hanking it with the bandages," the blood worked up among her fingers; and when she clasped it firmly with her hands, she felt the strong throbbing which caused it to bleed. She was always alarmed before the bleeding, with the tension, heat, and throbbing of the tumor. It burst out regularly every six weeks. For a year past it has displaced the

menfes, has ruined her health, and reduced her, I perceive, to extreme weakness.

Such is the faithful history of the disease, for which this woman is now to suffer a second operation. But there remains one circumstance to be told, of the most extraordinary nature. The tumor, which a few days ago was full, and of the size of a man's head, now hangs pendulous, in the form of a thick and fleshy bag, very thick and solid, but perfectly pendulous, livid on its surface, flaccid, and without pulsation, and with large scabs on the places from which the blood was used to flow. As she was travelling up to town, the tumor burst, and three chopins of a clear fluid were discharged in an instant from this tumor! which never before discharged any thing but blood.

The tumor was extirpated by a surgeon in this city, very dexterously, with two long strokes of the knife, which went quite round the root of the tumor; and dreadful as the hæmorrhagies had been, and although the incisions by which it was cut off were fully six inches long, not one drop of blood flowed; and after the tourniquet was entirely slackened, nothing that we could contrive could excite even the slightest hæmorrhagy. The incision was made pretty wide from the root of the tumor; one small artery only was tied; the patient did not lose even six ounces of blood.

We must take a particular interest in this disease; for such a tumor, so large, so livid, so foul and scabby, bleeding furiously, and returning after an imperfect operation! is but too apt to be called a cancer, and the patient to be condemned to a lingering death, embittered by continual alarms. Concerning the nature of this woman's disease, I believe you will have no difficulties; but this last accident, the discharge of a pure coagulable serum, and in such prodigious quantity, requires explanation.

Let me observe, that tumors of various kinds, and especially cancerous tumors, often produce an enlargement of all the adjacent veins; and were I now delivering a history of tumors (and I wish I were), I should describe to you a variety of causes from which such varicose dilatations and profuse hæmorrhagies arise. But I am delivering only a history of aneurisms, and have but to prove to you that this is no such hæmorrhagy.

Had this woman's disease begun with a serous tumor, surrounded by such dilated veins, the tumor, before it could have produced such enlarged veins, must

have been itself very large ; and while the transparent part of such tumor had been conspicuous, the veins must have been very small, the colour natural, the bleeding slight, and easily repressed ; and the turgescence of the tumor would have been accompanied with no sense of heat, with no sense of pulsation, much less with any actual pulse. On the contrary, this disease began not as a tumor, but as a flat livid spot ; it rose very slowly from the surface ; was soft, red, and of course vascular ; it was distinguished even at the beginning from any bag of serum ; its first bleedings were very violent and were preceded by distinct pulsation. How could the surgeon have punctured the tumor without seeing this serum ? He struck his lancet into it, and nothing but pure blood flowed ; he extirpated the tumor, and still saw nothing but a bag of blood.

Had one of the bursæ mucosæ of the knee joint been thus enlarged ; had the common cellular substance been formed into a serous tumor (which is a rare accident) ; had such serous tumor been the original disease ; had this serous tumor enlarged by its growth the concomitant veins ; and finally, had such complicated tumor burst again and again every six weeks ; the serous part of the tumor must have been perceived ; the serous part of the discharge must have been recognized and distinguished from the blood ? But of the hundreds of times at which it bled no serum appeared ; and behold, at its last bursting, it poured out all at once three pounds of serum, without one drop of blood. How can this be explained ! How could so great an aneurism pour out serum instead of blood ?

Let it be remembered, that when the surgeon first extirpated this tumor, after it had arrived at the size of a turkey's egg, he found in the centre of it a small cavity, no larger than was sufficient to contain a walnut ; and it was filled with a firm coagulum of blood. Let it next be observed, that in a tumor growing to this great size, much of its bulk will, in the progress of the disease, consist of various sacs. There must be in such a tumor large cellular cavities, as well as dilated veins.

Let it be remembered too, that the hæmorrhagy had, about five weeks before the operation, been exceedingly profuse ; that the whole tumor was flaccid when she set out upon her journey ; that the riding in an uncovered cart gave her terrible pain, and that the basis of the tumor was highly inflamed ; it may then easily be imagined how those small arteries, which were wont to discharge blood, had secreted a sort of serum, just as the menstrual discharge, which consists of blood alone, commences and closes with a very profuse serous discharge. Let it be consider-

ed, on the other hand, how the vessels of the stomach, of the bowels, of the kidneys, of the throat, of the nostrils, and even of the common surface of the body, are so dilated, as to discharge, instead of the common exudation or transpiration, pure and entire blood; which blood is poured out by anastomosis (as the ancients called it), i. e. by the open extremities of the vessels, and not from any breach of surface.

This tumor being dissected, is found to contain one large cavity, and some very small sacs, of the size of peas or gooseberries, as if they were incipient sacs like the great one. That these vesicles were generated by the vessels which form this tumor, is certain, from their being buried in the most solid parts of the tumor. Yet none of the tumor can be said to be solid; it is all of a singularly spongy texture; the extreme vessels ramify through it in a most singular manner, so as to form a cellular substance; and from these extreme vessels, as it appears to me, the blood had been poured out, like a sort of menstrual discharge.

Yet even my own senses could hardly have convinced me that this was a mere aneurism of the kind which I have described! Although I had seen this kind of aneurism in various gradations, so as to be assured (from the case, for example, of Jean Smith) that it might grow to an unlimited size, yet I had myself a degree of doubt; I waited anxiously for the report of the country surgeon; and that I might have an unprejudiced report from him of the nature of this tumor, I was careful to conceal my own opinion of the case. I mentioned the woman's disease as one which we apprehended might be a cancer, and begged to have the history of the first operation; and Mr. Adams, the surgeon, in his letter to me, describes the disease in those very terms which I have chosen as characteristic of this kind of aneurism. His letter is as follows: "Sir, Being from home on Sunday, I received your letter only last night, very late; and I fear, now that I do answer it, my information will be but little satisfactory to you or the gentlemen who have interested themselves about this woman. Whatever I remember concerning her I will mention with pleasure; but to answer all your questions, is, I fear, impossible, considering the lapse of time since the operation was performed, and that I took no notes of the case.

"It was about nine years ago that this woman first applied to me, when the tumor on the knee was about the size of a turkey's egg. That part which projected above the surface of the thigh was hemispherical, with one or two small

protuberances on the top, and one of these had a scab upon it, from which point it bled freely, when disturbed by any accidental cause. By these occasional hæmorrhages she was much reduced; but for the quantities of blood she lost, or the time this disease had continued, I must refer you to her own report. The whole tumor was of a natural colour towards the base; the protuberance was livid, and the most prominent parts were of a high red colour."

"In the course of a week or two after I saw her, the operation was performed in presence of Dr. Key. During the incisions *a number of small arteries started*, but two only required to be tied. She lost little more than four or five ounces of blood."

"The tumor adhered very firmly to the flesh of the thigh. The whole was supposed to be extirpated, yet such was the adhesion of this tumor to the muscles, that it is not impossible some small portion might have eluded the knife."

"On examining the tumor after extirpation, *there was a distinct sac in the centre*, which might contain a small walnut, it was filled with a hard substance resembling clotted blood. *The sides of the tumor had a glandular appearance, replete with small blood vessels*, thick towards the base, and gradually thin towards the top *."

"For a few dressings, escharotics were applied, the wound soon assumed a healing appearance, and in the course of a few weeks healed up. Neither Dr. Key nor myself supposed it cancerous at that time. The girl could give no distinct account of its duration; but we thought, from its appearance, that it must have been years a-growing."

* I cannot help remarking here how very correctly the descriptions of surgeons, who had no knowledge of this theory, correspond with the account which I have given above of the nature of this tumor. Mr. Hill, surgeon in Dumfries, having extirpated a tumor of this kind from the eyelid of a child, but with too small an incision, had actually left a considerable part of it behind, and was employed in cutting off the remaining diseased vessels with a seton. After the dressings had fallen off, he says, "I had then an opportunity of viewing circumstances more deliberately, and was sorry to see, that though the incision was begun within a strawbreadth of the eyelash, yet part of the tumor, which was within the socket, was left behind. In this *the large red arteries and blue veins made a very singular appearance, resembling net-work in a kind of whitish transparent jelly*. As I durst not attempt any more cutting, two threads of cotton were drawn in by a crooked needle below the bottom of that part of the tumor which remained, and were left as a seton-cord to consume it gradually. Red precipitate and burnt alum were tried separately with the same view; but they gave so much pain that the infant could bear neither of them. The cord, however, in a few weeks cut its way through, and destroyed the remainder of the tumor so fully, that slight dressings soon completed the cure."

"From the time of this operation I knew nothing of her condition till lately, when I was much astonished with the magnitude and other circumstances of the tumor. She was very poor, and had not a friend on earth to care for her; it was for this reason I advised her to go to the Edinburgh Infirmary to have this second operation performed. I remain, &c.

JOHN ADAM."

Let me now mention to you the chief circumstances of a very remarkable case related by Dessault; you will perceive in it many analogies, which will explain in some degree the difficulties of this case; you will perceive, that a pulsating aneurism of this kind may, by being irritated and inflamed, be brought into such a condition as to pour out serum only instead of blood.

"* Anne Vachot was born with a small excrescence under the chin, of the size of a small strawberry, but without heat, pain, or any change of colour in the skin. As it did not increase in proportion to the growth of the child, it attracted little attention, from infancy till the fifteenth year of her age there was little change; but from the period in which the menses appeared, it increased all at once; it was remarkably elongated, to double its size, and there distilled from the point of it a very florid blood; the hæmorrhagy became periodical, and so excessive as to produce an alarming degree of weakness; while a periodical headache and a slight giddiness preceded each return. But there was not, about this period, any change on the tumor, except a very sensible heat, and a slight enlargement of some small cutaneous veins."

"The influence of this hæmorrhagy upon her system was distinctly marked,

* Anne Vachot, de Saint Maury en Bresse, vint au monde, portant au menton une tumeur de la grosseur et de la forme d'une petite fraise, sans chaleur, sans douleur et sans changement de couleur à la peau.

Comme cette tumeur ne gênoit en rien les fonctions, on y fit d'autant moins d'attention, qu'elle ne paroissoit pas suivre les progrès de l'accroissement. Elle changea peu, en effet, pendant les cours des premiers 15 années; mais à l'époque des regles, son volume doubla tout-à-coup; elle prit une forme plus allongée, et l'on vit suinter par son extrémité un sang pur et vermeil, dont le flux qui s'établit avec une forte de périodicité, fut par fois assez abondant, pour amener une foiblesse allarmante. Chacun de ses retours étoit précédé de maux de tête considérables et d'étourdissemens passagers. Avant et après l'apparition de ces symptômes, la tumeur n'éprouvoit aucun changement dans son volume: seulement une chaleur plus vive s'y faisoit sentir, et quelques petites veines cutanées devenoient plus apparentes.

Les regles parurent enfin, mais en petite quantité, toujours avec irrégularité, et sans influer sur l'abon-

the menses became irregular and sparing, and the breasts hardly unfolded themselves when she had considerably passed the usual age."

"She was twenty-four years of age, when she was received into the Hotel Dieu of Lyons. This was no longer a slight deformity, but a serious disease; in the course of the three last years the tumor had acquired three times its original size; it resembled a middle sized pear, adhering by its basis to the chin; the heat was continual, and the expansive pulsation was felt at every point of the tumor, but especially at the apex, (the only point where the skin was become red, tender, and shining); there the pulsation was particularly felt, while the pulsation was deep and heavy towards the basis of the tumor."

"None of the arteries, subclavian, carotid, nor maxillary, had suffered the slightest change; there was no fluctuation in the tumor, nor could you make the slightest impression upon it by pressing with your hand; but you could distinguish with the finger some inequalities and hardnesses under the skin, like small lymphatic glands."

"However difficult it might be to suppose an aneurism in a place where the arteries were so small, yet the strong pulsation of this tumor, and its frequent hæmorrhages, gave reason to suspect, if not an actual extravasation of blood, at

dance de l'écoulement par la tumeur, ni sur la fréquence de ses retours. Les seins se développèrent aussi très-tard, et ne parurent pas recevoir, de l'approche de la puberté, l'influence accoutumée.

Cette jeune personne, robuste et bien portante, avoit atteint sa 24^e année, lorsqu'elle entra à l'Hôtel-Dieu de Lyon, le 4 Mars 1791. Elle n'avoit plus alors une simple difformité; c'étoit une maladie réelle, qui l'obligeoit de réclamer les secours de l'art. Dans le cours de trois années, la tumeur avoit acquis un volume triple: elle ressembloit parfaitement à une poire de moyenne grosseur, et adhéroit au menton par sa base. Son indolence étoit la même qu'auparavant; mais la sensation de chaleur, qu'elle faisoit éprouver, étoit devenue continuelle et plus forte. Un battement véritablement expansif se faisoit sentir dans toute son étendue, sur-tout à sa pointe, seul endroit où la peau rouge, luisante, amincie, parût avoir souffert quelque altération. Cette pulsation perdoit de sa force et sembloit devenir plus profonde, à mesure que l'on approchoit de la base de la tumeur, où enfin elle disparoissoit entièrement.

Les artères sous-clavières, carotides, maxillaires externes et temporales n'avoient subi aucun changement, ni dans leur calibre, ni dans le mode de leur pulsations. Aucune fluctuation ne se faisoit sentir dans la tumeur; la pression ne lui faisoit rien perdre de son volume; enfin le tact découvroit sous la peau quelques inégalités qu'on auroit pu prendre pour de petites glandes lymphatiques engorgées.

Quoiqu'il fut difficile de se prêter à l'idée de la formation d'un anéurisme, dans un endroit où les vaisseaux sont si petits, cependant le battement dont cette tumeur étoit accompagnée, et le sang qu'elle avoitendu, à tant d'époques différentes, devoient faire soupçonner, sinon un sang épanché dans son intérieur, au moins une dilatation considérable des vaisseaux qui la nourrissoient. On crut donc devoir, pour l'extirpa-

least a remarkable dilatation of the vessels which supplied the tumor. It was manifestly more prudent to use the ligature for the extirpation of this tumor than the knife."

"The ligature was applied the tenth day after her arrival in the hospital; the stricture was but slight, the tumor became painful, inflated, and very red; the scarf-skin separated from it, and there was a remarkable effusion of a serous fluid; the pulsations at first increased in violence, and continued such as to give the patient great distress, while the serous effusion continued equally profuse till the fourth day."

"On the fifth day there happened, in consequence of a small crack in the upper part of the tumor, a considerable hæmorrhagy. The blood stopped indeed, but the patient was weakened; obscure pulsations were still felt in the tumor; the serous discharge continued; the phlictenæ and points which discharged the serosity, began to whiten and suppurate; the ligature was tightened from time to time, and when the tumor seemed quite deadened, and hanging by a pedicle, it was cut off with a knife, discharging only a few drops of blood."

tion de cette tumeur, préférer la ligature à l'instrument tranchant; quoique la mâchoire inférieure eût pu fournir un point d'appui suffisant pour la compression, dans le cas d'hémorrhagie, et que la ligature ne fût pas propre à rassurer contre l'accident que l'on redoutoit, et qu'elle eût au contraire, de plus que la compression, l'inconvénient de rendre plus difficile l'application des moyens par lesquels on auroit pu dans le besoin, se rendre maître du sang.

Quoiqu'il en soit, la ligature fut partiquée, dix jours après l'arrivée de la malade à l'hôpital; et comme elle fut peu serrée, la tumeur s'enfla, devint douloureuse et trèsrouge; l'épiderme se souleva en phlyctènes et donna issue à une quantité considérable de sérosité. Les battemens, qui avoient d'abord paru diminuer, se firent bientôt sentir avec plus de force, et se soutinrent de manière qu'ils devenoient fatiguans pour la malade. L'écoulement séreux continua, les jours suivans, avec la même abondance, et ne se rallentit que le 4^e.

La nuit du 4 au 5^e jour après la ligature, il se fit une hémorrhagie considérable, par une petite crevasse de la partie droite et supérieure de la tumeur, dont les battemens parurent alors affoiblis, sans qu'elle eût rien perdu de son volume. Le sang s'arrêta de lui-même; mais il fallut veiller sur les forces de la malade, et les soutenir par des cordiaux.

La journée du 6 fut tranquille: la tumeur parut alors offrir plus de rénitence; les points de sa surface, où il s'étoit formé des phlyctènes, blanchirent et commencèrent à suppurer; il sortit encore un peu de sérosité.

Le 7, l'on sentoît encore des battemens obscurs. La malade se trouvoit mieux; ses forces s'étoient relevées; la ligature, qu'on avoit resserrée à plusieurs reprises, avoit déjà divisé la tumeur profondément; enfin, le 11^e jour, comme la ligature ne paroissoit plus tenir que par un pédicule étroit, et que les hémorrhagies ne s'étoient pas renouvelées, on acheva de la séparer avec le bistouri. Il sortit à peine quelques gouttes

These gentlemen found it difficult to conceive this to be an aneurism, because the only aneurism they could imagine was the dilatation of some single arterial tube; what is commonly called a True Aneurism! But the singular size of this tumor, and the extreme smallness of the maxillary arteries, the vast disproportion betwixt such an aneurism, and any individual artery, forbade such a conclusion.

It is to be observed, that this being an aneurism from anastomosis, its arteries were small but wonderfully active; they were excited in paroxysms, they took upon themselves the function of menstruation; and puberty had hardly appeared, and menstruation begun, before these vessels increased to a great size, or poured out so much blood as to supersede the menstrual flux.

It is next to be remarked, that while this set of active arteries were thus periodically excited, they were also capable of being excited by any occasional irritation; and thus their high action, quick pulsations, and occasional hæmorrhages marked the nature of the disease. When the ligature was put round this tumor, which it could not entirely compress, one part defending another, those central parts which were not compressed were irritated; a deep, incessant, and painful throbbing came on, and lasted for five days; and during that time, the serous discharge took the place of that effusion of pure blood, which was wont to flow in the uninflamed state of the tumor. A new secretion took place like that which, even in its most natural state, ushers in and closes each menstruation.

All the other analogies of the case, I will leave to your own ingenuity; you easily foresee how, in such aneurisms, various sacs will be formed, and how they may be replenished with other secretions besides blood. One part only of Desfault's report, I must not neglect to state to you. "The tumor being opened, presented a white cellular texture, firm, lardy (*comme couenneux*), interspersed with numerous blood vessels, which seemed to be profusely scattered under the skin."

Of such tumors arising spontaneously in adult years, I find hardly any recorded. There is, indeed, one case related by Mekren, which I shall mention as a warning to the young surgeon not to meddle rashly with any tumor till he

de sang. La plaie fut pansée à plat, et n'offrit rien de particulier jusqu'à la formation de la cicatrice, qui fut parfaite, le 19 Avril, 26 jours après la séparation complète de la tumeur, et le 36^e de la ligature.

La tumeur ouverte ne présenta qu'un tissu cellulaire blanchâtre, dur, comme couennex, dans lequel ram-
poit un assez grand nombre de vaisseaux sanguins, qui paroissoient répandus sous la peau, avec plus de pro-
fusion que dans l'état ordinaire et naturel. MARC. ANTOINE PETIT.

have thoroughly reflected on its nature; nor even to puncture tumors, however trivial, which have any degree of pulsation, or which contain blood.

“ Maria de Waart, younger daughter to a senator of Amsterdam, was relieved from chronic pains of the head, ears, and teeth, by the forming of a whitish tumor on the palate, of the size of a walnut. Both physicians and surgeons believed it to be a small abscess; at our instance (says Mekren) the patient submitted to the operation; the tumor was opened with the lancet, when, instead of pus, pure and florid blood flowed in great profusion, which we were obliged to repress with permanent compression of the finger.”

“ In five or six days more, we opened the tumor again, which was now greatly enlarged, and unquestionably contained pus, so at least we believed! but no sooner was the incision made, than the hot blood issued with such impetuosity, that we were obliged to suppress the hæmorrhagy by thrusting lint into the wound.”

“ Seeing these attempts had been thus unsuccessful, it was thought by no means prudent to open such tumor again, but to endeavour, by time and applications, to convert the blood into pus. To this effect, we ordered a decoction of marshmallows, althea, lintseed, figs, &c. sweetened with syrup of althea, to be held warm in the mouth. By such gargarisms, we daily observe tumors of this kind dissolved, but this one was not cicatrized without a previous exfoliation of the palate*.”

The nature of this tumor is very manifest; let it be a warning to the young surgeon, who sometimes finds himself thus unawares engaged with an enemy he does not expect. This must have been a small aneurism by anastomosis, which had been so long neglected, as to have spoiled the bone. Mekren congratulates himself on having recollected that hole, described by Schultetus, through which arteries and veins pass down to the palate from the nose†.

Whether some history of such a tumor arising spontaneously, and in an adult person, may not lurk in some odd corner of an old book, I do not know. I have a suspicion that it is the disease mentioned by Mr. Pierson of the Lock Hospital‡.

* Mekren, page 267.

† Curatione sic insperata absoluta nostrum credimus esse, unde collectio sanguinea dicto loco se exhibens proveniret cognoscere: Nullus hic occurrit qui vel verbis vel scriptis vias commodus indicare potuit. Aliquid lucis huic difficultati adferunt quæ ob. 24 Armament. Chirurg. proponit Joan. Scultetus medicus et chirurgus ulmenfis ductum hic describit circa dentes molares a palato ad nares extensum, in quo vena atque arteria commodæ tunnicæ inclusæ detinentur, &c.—MEKREN.

‡ Vide Medical Communications of London, Volume II.

Mr. Pierſon ingenuouſly confeſſes himſelf at a loſs to aſcertain the nature of the diſeaſe, for me to pretend to explain it, were nothing leſs than preſumption. But the caſe related by the late Mr. Elſe, of John Callahan, a mariner, who fell upon an anchor ſtock, had ſurely been an aneurifm of this nature *.

Except theſe two caſes, which I rather ſuſpect than believe to have been aneurifms from anaſtomofis, all the caſes related by authors, have been either of purple and bleeding ſpots, which were perceived at the time of birth; or have been caſes ſo irregular and dangerous, and ſo little underſtood, that they have been thrown into the common chaos of indeſcribable and incurable diſeaſes; they have been called ANOMALOUS CASES, or BLOODY TUMORS. But every bloody tumor muſt have a cauſe? muſt proceed from a wound? a bruife? an enlargement of one or more veſſels? it is ſurely then our duty to inquire carefully into every ſuch diſeaſe.

Of thoſe purple and bleeding ſpots or deformities, and of the ſpontaneous aneurifm from anaſtomofis, the nature and internal ſtructure, is unqueſtionably the ſame; but the nature of the one is obvious at firſt ſight, the hiſtory of the other requires a ſerious and diligent inveſtigation. Thoſe purple ſpots, eſpecially if ſoft, hollow, and not upon the ſurface, but within the ſubſtance of the ſkin, are never without danger; they ſhould be cut out early, both as they are growing deformities, and as tumors which may eventually come to ſuch a ſize, as to injure the health by repeated hæmorrhages, or even to prove fatal by burſting out during the night. Frequently we have no choice, they are ſometimes ſeated upon the lips, and protrude (as in the caſe related by Severinus) ſo much, as to prevent the child ſucking. The more protuberant of thoſe tumors, may be cut off by a ligature; thoſe which are flatter, though protuberant, have yet a broader baſe, and may be killed by ſtriking a needle through the baſe of the tumor, and tying the threads of the ligature on either ſide. The ſureſt way is the knife, for in uſing the knife, you know when you have extirpated the tumor, and you bring the lips of your incision to approach ſo as to leave little mark.

But the aneurifm which I have been deſcribing, though it differs from theſe con-nate aneurifms in no eſſential point, ariſes, you perceive, either ſpontaneouſly or from a blow. The diſeaſe may form in any part of the body. I ſhould have named it cutaneous aneurifm, but that it occupies all parts of the body, the viſcera as well as the ſkin. Its colour, pulſation, and frequent bleedings, are ſure marks of the

† *Vide Medical Obſervations and Inquiries, Volume III. page 170.*

disease; and whether large or small, the tumor is still of the same nature*. It is a congeries of active vessels, communicating sometimes with cellular substance only†, sometimes with larger cells‡, and sometimes forming remarkable sacs in the centre of the tumor. This aneurism is a mere congeries of

* Sed et lacteolæ infantis, vix semestri spatium emensæ, Andreæ cujusdam holoserici mercatoris filiolæ, atro cruentum tuberculum labio inferiori agglutinatum nedum observare mihi contigit, sed et curare, molliusculum, non æquabile, interne etiam prominulum, testudinis terrestris ova majus; cujus objectu laboriose, cumque ejulatu, simul et exsuctu minus felici, remixtis, infantula victum attingebat. Ac ne attingebat quidem, ne proinde adjutans nutrix prompta manu, compressis assidue mammis, quæsitam nectaris guttulam aridum in os infunderet: ad quam calamitatem diurnam, nocturnamque, levandam accitus ego, miseris in rebus adhiberi solitus sum, non tam pœoniam quam chironiam opem necessariam denuncio; cui decreto remissus à parentibus nuncius continuo fuit, qui tamen, post aliquod tempus, auxilii cujusque puelulam videntes exortem infortunioque obnoxiam, perpetuo per deum, perque homines, orarunt me supplices mature succurrerem, ferre nec se nec misellulam infantulam posse longiora supplicia.

Tum accedens paratis omnibus, quæ de more requiruntur, aureis ignitis scalpellis, sanguineum offensamentum omne sum demolitus; sanguis quid quidem fluere paratus et abunde fluens doctis nonnullis adminiculis retrocessit; curatum empyreuma per dies plures; interea dum expressa de papilla per manum lacte sustineretur infantulæ vita, perpurgata caro, cicatriculam recepit, vivitque puella læta jam annis et libera. Illud jam non est omittendum, natam infantem de matre sanguineæ plenitudinis et corpore sane præfarto; ut videantur jam apte respondisse, superflua foetus concrementa generationi et sanguinis affluentis undique primordiis.

Alter infans mihi sese obtulit, hoc anno 1642, sexto plus minus mense natus, cujus labium item inferius mirabile visu fuit; nam magnitudine præaltum, ut pueri ipsius pugillum æquaret, naturalem formam tum interne, tum externe excedens, colore violaceo, aliquando dilutius, venarum furculis quam creberrimis distinctum; figura linguæ testudinis marinæ, id est, crassis seu bucca seu mento tenus initiis in quoddam quasi rostrum et in sinum dedolatum ad summam de ore infimo exstabat, modo pinnulæ pulmonis leporini; quæ quidem animantis pinnula, objecta matri fuerat cum utero gestaret in esum appetita medici mensibus: extra autem opinionem nostram de suctu infantis sciscitati rescivimus, in tam magno offensamento neque amissum infanti suctum, et hoc etiam lac sibi prolicere non difficile: sic edocti scilicet et instructi à natura procedimus ad exsuctum, quam rem adulti vix ullo possumus ingenio comparare. De vitii vero curatione requisiti respondimus, præterquam ab lactatam infantem non adigendum in chirurgi manus, nisi grandiusculum factum, tum futuram tutiorem curationem, quando vita pultibus et forbilibus sustineatur; in cujus alioquin discrimen facile, hoc præcipue tempore, et per ulcus, et per sanguinis compescendi, necessitates, sublato suctu liquido conjiceretur; qui puer, et matre prognatus est summe melancholica atque hepate re-torrido: ut peracri phantasia illud monstri pareret in suo genito; sed de hisce natis infantium sub utero impressis alias fortasse privatim.

† As in the case of Mr. R——, whose tumor, though it yielded a little to pressure, was comparatively little affected.

‡ As in the boy N——'s case, where the tumor had large cells, and could be almost entirely flattened by the continued pressure of the hand.

active vessels, which will not be cured by opening it ; all attempts at obliterating them with caustics, after a simple incision, have proved unsuccessful, nor does the interrupting of particular vessels which lead to it affect the tumor ; the whole group of vessels must be extirpated. In varicose veins, or in aneurisms of individual arteries, or in extravasations of blood, such as that produced under the scalp from blows upon the temporal artery, or in those aneurisms produced in school-boys by pulling the hair (and also in those bloody effusions from blows on the head, which have a distinct pulsation), the process of cutting up the varix, aneurism, or extravasation, enables you to obliterate the vessel and perform an easy cure. But in this enlargement of innumerable small vessels, in this aneurism by anastomosis, the rule is, " not to cut into it, but to cut it out." These purple and ill-looking tumors, because they are large, beating, painful, covered with scabs, and bleeding like a cancer in the last stage of ulceration, have been but too often pronounced cancers ! incurable bleeding cancers ! and the remarks which I have made, while they tend in some measure to explain the nature and consequences of this disease, will remind you of various unhappy cases, where either partial incisions only had been practised, or the patient left entirely to his fate.

DISCOURSE XII.

ON FRACTURES OF THE LIMBS.

INTRODUCTION, CONTAINING A HISTORY OF THE OPINIONS AND PRACTICES OF THE OLDER
SURGEONS.

PERHAPS there is no subject more interesting to the practical surgeon than this of fractures of the limbs; yet I would neither deduce its importance from the frequency of simple fractures, where the limb becomes shapely or remains deformed, according to the skill of the surgeon; nor from the shock which the whole system feels in consequence of a lacerated fracture, where fever and death not unfrequently ensue; nor from the destruction and crushing of the limb, protrusion of the bones, and laceration of the joints, which make injuries of the limbs almost as inevitably fatal as wounds of the great cavities: Nor, lastly, from the difficulty which all liberal men acknowledge of deciding whether a limb thus shattered should be sacrificed or preserved at the imminent risk of the patient's life. These are indeed natural difficulties, but they are such as we should feel very slightly, were not this one of those subjects which has fallen into almost inextricable confusion! none, I believe, requires more to be historically explained.

Ask a young man who has studied his profession faithfully, what he would do with a fractured limb? he cannot tell. Ask the same question of one who has practised his profession long, who has, moreover, practised it well and sensibly? He can hardly tell how he himself is accustomed to manage a fractured limb! He has no rule nor settled method! he waits for the particular case, trusts in his own consciousness of sense and experience, and provides for difficulties only after they have come upon him. Ask the man of books and study what have been the doctrines of the old, or what have been the actual improvements of the modern surgeons, he also is at a loss! theories, bandages, machines, improvements innu-

merable, he can well remember ; but together with these recollections this conviction always rests upon his mind, that the subject which he has long regarded as the most interesting, is the only one which he has in vain endeavoured to understand.

Degrading as this may appear to our profession, it is, I fear, but too certain, that while more has been written on the subject of fractures than on hernia, lithotomy, amputation, or trepan, yet no two books correspond, no two authors agree, even on the general points of practice ; and every surgeon, whether in the army or in the navy, in a village or in a city, sets a broken limb as he writes his name, after a fashion of his own. There is no rule nor principle yet established ; this is almost the only department of practice which has been continually changing, without ever being improved.

When I revolve in my mind various methods of explaining this perplexed subject to you, the following points present themselves as the most natural divisions of my discourse. They contain general views, which will enable me in the end to lay down correct and absolute rules for your conduct, and will also, if I do not deceive myself, give some degree of consistency and steadiness to your practice.

First, We will consider the opinions, the prejudices, the formal operations, and the daring practices of the older surgeons, who took upon them to regulate the quantity, the form, and the consistency, even of the callus ; to pare it when exuberant, to repress it when unshapely, and to break it when they were at any time displeased with the form of the limb. The discussion of their doctrines will serve as a general theory for the subject ; and in the course of it I will attempt to explain to you the process of healing as it goes on within a broken limb.

Secondly, I will explain to you the definitions and arrangements of fractures. Definitions are now too much neglected and contemned, because the old writers delighted only in this false science, and were skilful in nothing but intricate arrangements and unmeaning distinctions. But in truth, the definitions and distinctions of fractures are of the very highest importance ; the very name of each species of fracture should convey to the mind of the student, the idea of some peculiar decisive line of practice. Good arrangements in our science are like an artificial common sense, by which those who have not natural ability to decide upon any individual case, are taught their duty by its place in the system ! Arrangement is thus a necessary preliminary to general rules ; and I shall so ar-

range my definitions, as that each subdivision of the subject may turn out a distinct and marked case.

Thirdly, I will explain to you the accidents of the hip joint, its luxations, its fractures, its lingering suppurations, caries, and anchylosis; and I believe there is no subject within this department of fractures, which can be equally interesting to you; for the joint lies buried so deep among the surrounding muscles, that its accidents are apt to be mistaken even by the most experienced surgeons, while protracted suffering, and incurable lameness, are the consequence of the slightest mistake.

Fourthly, The fracture of the thigh bone I shall consider as a distinct subject deserving particular notice. The retraction and shortening of the thigh is an unavoidable consequence of the vast size and power of its muscles; it is in this case alone that the limb is remarkably shortened; and the ingenuity of surgeons has been employed for ages in inventing machines to resist this retraction, which, however ingenious, have produced nothing but torture to the patient, and disgrace to the surgeon.

Yet these machines, imperfect as they are, shall be explained; and were there much of this kind to praise, it should not be passed over in silence. But I may perhaps do you some service by explaining the simple principles of this department of surgery, and then you will be able to enter into the magazines of Schultetus, Hildanus, and Paræus (filled with engines not unworthy of the chambers of the Inquisition), without being tempted to bring out along with you any of their lumber.

Fifthly, While explaining these various subjects, I hope to make you gradually acquainted with the true principles of surgery; and it is only after having accomplished this, that I shall think myself entitled to lay down rules for each individual case, or to close these discourses with general aphorisms.

Perhaps you are chiefly anxious to learn how you are to bandage a fractured limb; but in the very opening of this subject, I must declare, that if there be any great and general error in ancient or in modern surgery, it is that of bandaging a fractured limb. It seems to have been by the number of turns, or rather by the number of bandages which they could roll round a limb, that surgeons at one period estimated their own skill. They have left us no doubt of their intentions, for this was their theory, and they were proud of it, "that while the callus was

still soft, it was moveable, and you could mould it by compression and bandages just as you could model putty in the palm of your hand."

The Arabians attended in a particular manner to the form of the callus; its exuberance was supposed to be a sure consequence of a slack bandage, the deformity of the limb was imputed to this cause, and was considered as a disgrace to surgery; they took upon themselves the whole management of the callus. Such was the firmness with which the Arabian surgeons applied their bandages, that not only while the callus was growing, did they draw their bandages within a very hairbreadth of producing gangrene, but they continued them afterwards to prevent the prominence of the callus, till, by their tightness, the limb was wasted; and much trouble had they in plumping it up again, "by filling the man with wine, and pleasant tales, and luxurious bathing, and plastering the limb with pitch, to draw the nutritious juices that way *."

If all the surgeons of Europe had been bone-fetters, merely learning their trade by tradition, they could not have delivered down the Arabian methods of firm bandaging more carefully than they have done. They have described, even in the most simple fracture of the leg or fore-arm, three or four bandages rolled one above another, with splints, and cushions, intricate and innumerable, as if a limb could never be too securely tied. Each bandage was of many ells long. Of these three

* This wasting of the limb, its causes, and its cure, are explained in Albucasis. The effect of such bandages we must suppose to have resembled expressly that wasting of the limb which lame sailors and other mendicants contrive to produce by firm bandaging, and never fail to mark by a red garter twisted round the limb. *Quando restauratur fractura ossis, et remanet membrum post illud subtile, debile: tunc non fit illud nisi propter causas multas. Quarum una est, multitudo solutionis ligamenti et ligationis ejus non secundum quod oportet: aut propter superfluitatem strictionis ligamentorum, donec prohibeatur nutrimentum currere ad membrum: aut propter multitudinem embrocationis superflue in non sua hora: aut propter paucitatem sanguinis in corpore infirmi, et debilitatem ejus. Et curatio illius est, cibare infirmum, et tenerum facere corpus ejus, donec multiplicetur sanguis in eo. Et administra balneum. Et intromitte gaudium et laticiam super eum. Deinde pone picem super membrum: ut attrahat pix ad ipsum nutrimentum multum. Et assiduet embrocationem ejus cum aqua tepida, donec currat nutrimentum, et redeat ad figuram suam naturalem.*

We are sorry to see one so often quoted, and of such high authority in surgery as Fabricius, copying the absurdities of Albucasis, directing the same nourishing diet, the same warm bathing, with this pitiful conceit of his own, "to bathe the patient in pure water, in which it will not be amiss to boil some beef."

"Si membrum gracile reddatur vel remaneat propter nimiam fasciarum strictionem, &c. Aeger nutriendus est deinde administrandum balneum ex aqua dulci, in qua si aliqua portio carnis decoquatur erit melius." FABRICIUS.

rollers, the first was passed round and round the part immediately fractured; by which rolling, and by certain compresses, which they sometimes laid in a circular direction about the fracture, they expected to regulate the shape of the callus, to prevent knots, and to limit its growth. The second passed spirally round the leg or arm, all its turns winding from below upwards; for this spiral bandage they could not give so fair a reason, but of the third roller they could give a good account; the third roller passed spirally round the limb from above downwards, "to antagonize the spiral turns of the second." Over these three rollers, were laid cushions or pads of linen, folded of such thickness as to have the effect of compresses, four of which, moistened in spirits and vinegar, were laid along the limb. These also were for the purpose of regulating the callus, and were kept in their place by being rolled with a fourth bandage *. Over these bandages and compresses were laid the splints, made sometimes of stiff pasteboard or thin deal, sometimes of sticks with straw rolled round them, sometimes of plates of metal, as brass or steel; and these splints, which were (as the marginal drawing, page 495. expresses) much too short to have any command of the limb, or to make any compensation for the suffering of the patient, were secured with a fifth roller, which is seen in this drawing of Schultetus. Nay, even such a writer as La Motte is proud of having dressed a leg, which was broken in two places, with two different sets of short splints, one near the ankle, and another near the knee †.

The leg, at every turn of each of these five rollers, was lifted up and handled, with great torture to the patient! When this bandaging was finished, the limb was as big as his body; and long before it was brought to that size, the surgeon

* When the callus was knotted, and the leg clumsy, it was always ascribed to the unskilfulness of the surgeon. Witness the following passage from the great Petit.

"Le cal est difforme pour n'avoir pas été suffisamment borné par le bandage, ou parce que les os n'ont pas été bien réduits. Il n'est pas toujours possible de borner l'accroissement du cal, particulièrement quand la douleur, l'inflammation et autres accidens empêchent de faire un bandage ferré; mais il arrive souvent que le cal n'est difforme que par la faute du chirurgien, comme lorsque sans raison, il ne serre pas suffisamment et également le bandage, pour s'opposer de toutes parts à ce que le suc osseux ne s'épanche dans le voisinage de la fracture. La difformité du cal est plus grande dans les fractures qui n'ont pas été bien réduites, tant parce que les bouts de l'os montent l'un sur l'autre, que parce que le bandage ne peut pas comprimer également, ni par conséquent borner, comme il conviendrait, l'accroissement du cal."

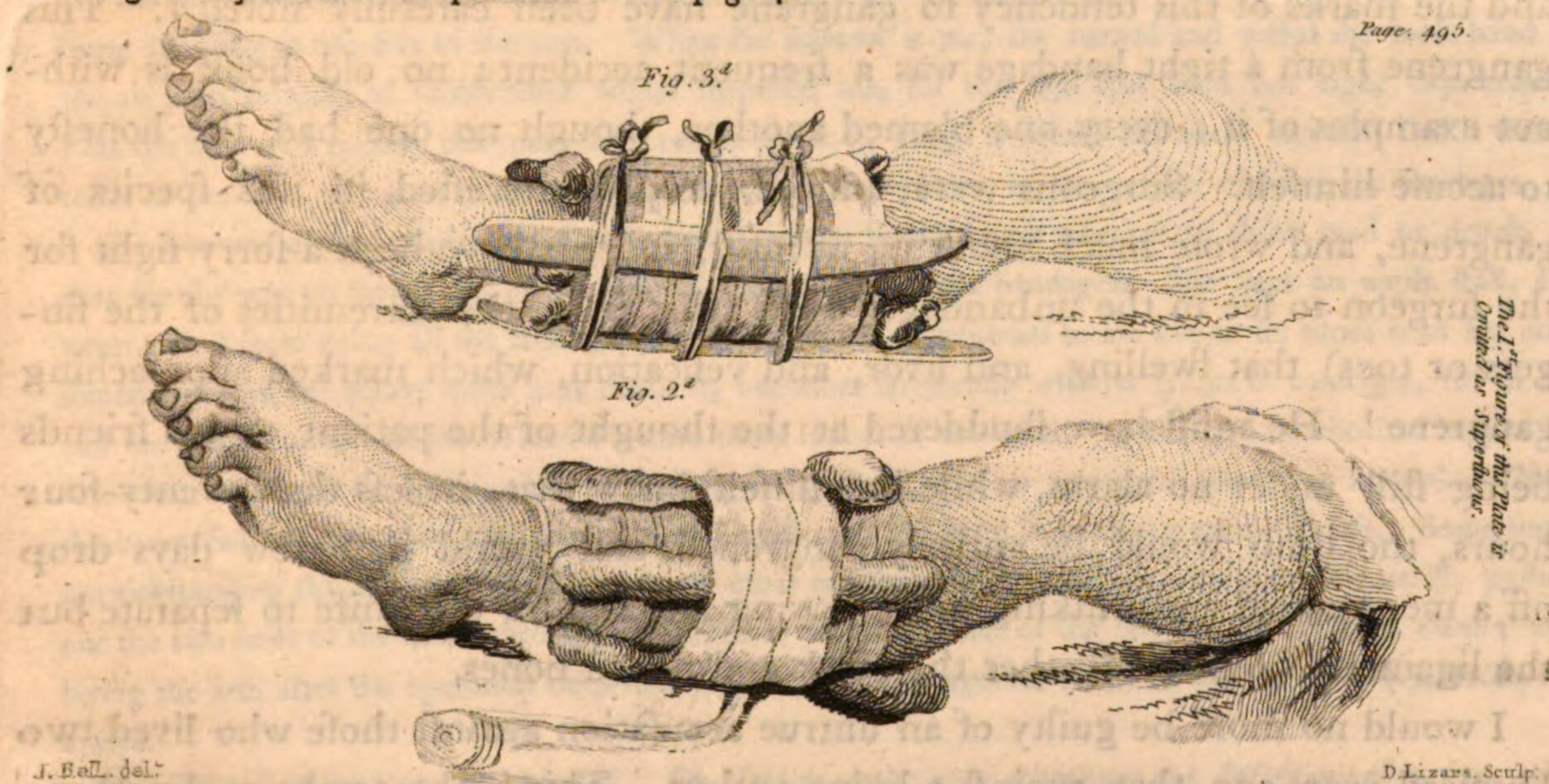
† These splints of straw, &c. were not flat like ours, but made of a pretty thick rod, like the thickest hazle switch, and wrapped round with straw till it became as thick as a batton. One was laid along each side of the fractured leg.

and all his assistants were exhausted with the work *. The old surgeons were as curious in the days appointed for taking off these bandages, as a midwife about the periods of giving suck after delivery, or rising from bed, or going to church. They took off the splints on one appointed day, the pads or cushions on another, and the innermost rollers on a third. They had even a bandage which they put on during the weeks of convalescence, after those with which the limb was first dressed were removed.

These were bandages which none but a regular surgeon could apply; and to say the plain truth, I think we have very innocently followed down to the present day practices contrived in mere cunning, and which had no other purpose than to preserve the trade of surgery, in all its branches, to its rightful owners †.

On these bandages the whole of the cure seemed to rest, and therefore the surgeons were inexorable in refusing to take them off before the day appointed by canons of surgery. No wonder that they permitted their patients to suffer any degree of pain, to fret during the day, and cry during the night, rather than un-

* Pott represents the process, even in our own times, as so tiresome, "that the labour of rolling a limb is among his objections to the practice." *Vide* page 401.



† In this marginal plate I have represented the three stages of this important process of the setting a fractured limb. In Figure 1. is seen the manner of applying the first roller, to moderate the efflux of callus; in Figure 2. is seen the manner of applying the compresses of linen over the first and firmest roller; and in Figure 3. is seen the manner of applying the splints on the outside of all the rest of the apparatus.

dertake to undo an apparatus so absurdly complicated. Verduc says *, “ Let the patient cry or roar ever so much, this is still a certain rule, that if your bandage is right, all the most considerable pain will cease in twenty-four hours ; for such patients make a great deal of noise and whining for a trifling pain.” This advice of Verduc’s needs no comment, it implies that these ways of bandaging were attended not only with pain but with danger. The degree of swelling in a bandaged leg was watched with extreme anxiety. It was in the surgery of those days a canonical rule, that the limb should be so bandaged, that there should be a slight degree of tension and swelling, so as to indicate a degree of straitness in the bandage, but not much, lest the limb should fall into actual gangrene. Thus the patient lay in imminent danger ; the apparatus was such as could not be easily undone ; the surgeon was often far off ; the patient thought it his duty and his interest to bear that pain which he was made to believe was necessary to his cure. Even when the surgeon was present, he had so little regard for his patient as to let him “ roar and cry” sometimes a little too long ; and the consequences of this are well known, for the tightness of the bandage of a fractured limb has been mentioned among the causes of gangrene in all the books of surgery, and the marks of this tendency to gangrene have been carefully noted †. This gangrene from a tight bandage was a frequent accident ; no old book is without examples of it ; every one blamed another, though no one had the honesty to accuse himself. Surgeons were, indeed, deeply interested in this species of gangrene, and wrote much about it ; it must, indeed, have been a sorry sight for the surgeon to see in the unbandaged parts (that is, in the extremities of the fingers or toes) that swelling, and livor, and vesication, which marked approaching gangrene ! He must have shuddered at the thought of the patient or his friends being still under no alarm, while he himself knew that, in less than twenty-four hours, the limb would be entirely gangrened, and would in a few days drop off a mere putrid and stinking mass, leaving nothing for the knife to separate but the ligaments holding together the black and naked bones.

I would no more be guilty of an untrue accusation against those who lived two hundred years ago, than against a living author. This is the truth, and nothing but the truth, and might be my warrant for rejecting altogether this practice of rolling broken limbs.

* Page 399.

† Mr. Gooch, Dr. Aitken of Edinburgh, in their Treatise on Fractures.

In the present day, though there are doubtless few so entirely ignorant as to think of modelling the callus by the tightness of their bandage, yet there is hardly any surgeon who does not think it his duty to bandage a fractured limb, for there is an apprehension of another kind which has taken strong hold on the public mind! It is a more rational, and therefore a more dangerous prepossession, "that the slightest motion will discompose the callus, that frequent accidents will prevent its being formed at all *." And worst of all, it has been universally believed (to use the words of the very latest writers on the subject) "that the small-

* There can be no doubt that perpetual motion will prevent the continuity of vessels betwixt the ends of a fractured bone being restored, just as perpetual motion would prevent the adhesion of an external wound; and you may imagine, that when the ends of the bones are by continual motion prevented from uniting, they will become smooth. You can also easily imagine, that while the continuity of the vessels of the bones is obstructed, the membranes and surrounding parts will heal, and will seem to surround with a capsular membrane that cavity which is preserved by the motion of the bones.

This is what is called an accidental or unnatural joint, which happens most frequently after fractures of the two bones of the fore-arm, though sometimes it happens in fractures of the single bone of the arm. When the fore-arm is broken, the patient, after the first inflammation has ceased, feels not much pain; and if he persist in moving his arm, he at last moves it with ease, and establishes his unnatural joint. An old woman came to me with her fore-arm broken; the broken part of the arm bent so that the hand hung dangling to one side of the arm. When she showed it me, she turned and tossed the loose hand in the air with a degree of indifference which surprised me, for the arm had been but eight days broken. I set the arm with splints, put many firm rollers about it, slung it round her neck, and also tied it with a roller to her side, and gave those operations an air of importance, to prevent her undoing the bandages.

She was one of those tipsy, crazy creatures, that you hardly know whether to think mad or drunk. I dare say she was no sooner out of my sight than she undid all the bandages. She kept an apple stall, and never rested from doing all the trifling things about it. She returned to me five or six times with her arm, sometimes with the rollers quite slack about it, but more frequently without splints or bandages, till in the end she had an unnatural joint formed within three inches of the wrist. A shoemaker who had broken his fore-arm, would not be restrained from working at his trade, and an unnatural joint was formed. When the bones fail to unite, they move like a second wrist, and the hand is weak, or rather useless. Sometimes, notwithstanding the difficulty of the radial and ulnar arteries, the surgeon has cut upon the wrist, pushed out the two ends of the bones through his incisions, pared the ends of the bones, and replaced them; and laying the arm after the operation on a steady splint, like a compound fracture, the bones have perfectly reunited.

This is an accident long ago observed. Du Verney, page 129. mentions the dissection of a man who had such a joint formed about four fingers breadth above the wrist; the upper ends of the two bones, the radius and ulna, were united by a clumsy callus at the place of the fracture; and on the face of that broad callus was formed a sort of socket, which received the lower fractured ends of the bones, which were smooth, and accommodated to the socket; the socket, indeed, was moulded upon the ends of the bones.

est alteration of posture, for the sake of ease, will often defeat all that has previously been done *." The old doctrine goes upon new wheels; the ancients used firm bandages to keep down the callus, and modern surgeons use firm bandages to keep the limb steady during the cure.

I need quote no authority for what every one believes, for a principle which is universally regarded as the very chief foundation of all our practices and precautions. I do not know a man who would not be ready at this moment to defend this opinion, that the slightest motion will destroy the callus and retard the cure; but I can hardly imagine any one so hardy as even to acknowledge this prejudice, after the real state of ossifying callus is explained. When we shall have examined into the genealogy of this doctrine, and compared it with certain facts, you will, I doubt not, agree with me, that it is ill entitled to a place in our theory, and by no means deserves to be respected in practice.

Every thing plainly shows that the older surgeons believed callus to be a mere inorganic concrete, a fluid poured out from the extremities of the ruptured vessels, which was soon hardened into bone; that it set or hardened like stucco or Paris plaster, and if not discomposed during this process, hardened into the consistence of bone. They described it always as "an exudation of the bony juice," and certainly imagined it to run like lead from a plumber's ladle, and, like it, to concrete, after being poured out from the ends of the bones. They thought callus a juice which distilled from the ends of the broken bones as gum from trees, sometimes too profusely, sometimes too sparingly. The reunion of broken bones, and the hardening of this callus, they familiarly compared with the glueing together of two pieces of wood, or the foldering of a broken pot †. The callus they supposed to be a peculiar juice circulating in the bones, ready to be poured out, so

This is most probably the preparation of the wrist of the street porter mentioned by Palfin in the following terms:

"Un Porte-faix de Paris, qui eut les deux os de l'avant-bras fracturez, n'ayant pas voulu se faire panser selon les regles de l'art, mais à sa fantaisie, les os ne se consoliderent pas, et le suc nourricier s'étant épanché sur l'extrémité des os, s'ossifia de maniere que l'avant-bras se mouvoit à l'endroit fracturé, comme il auroit pu faire dans une véritable articulation. Cet homme étant mort quelque tems après, le chirurgien, qui avoit été obligé de faire le bandage selon le caprice du blessé, eut la curiosité d'examiner les os de son avant-bras, qu'il trouva badiner dans un cercle osseux, sans être réunis à leurs extrémités. On a conservé ces os, que j'ai vû démontrer plus d'une fois à Mr. Duverney, au Jardin Royal des Plantes."

* *Vide* Mr. Gooch, Dr. Aitken of Edinburgh, in their Treatises on Fractures, &c.

† "Car ainsi que l'on joint les pieces de bois avec de la colle ou les potiers d'estain leur pots. Ainsi nature cement les os rompus avec le callus." AMBROSE PAREE, p. 343.

as to reunite them when fractured * ; and they imagined that it sometimes flowed into the joints so as to cause ankylosis, and often caked and knotted about the broken bones so as to form a clumsy, prominent, unsightly lump. They imagined that callus was a juice which infallibly congealed in a marked period of time, and therefore they appointed particular days for undoing the bandages of each particular fracture. They supposed that its exuberance might be suppressed by a firm and well rolled bandage, its knobby deformities corrected by pillows and compresses ; that it might be thumbed and modelled by pressure into a perfect shape ; that it might be softened by friction and oils so as to be twisted and set anew ; and it is believed even at this day, universally believed, that if the callus be decomposed in the slightest degree while forming, it may perhaps never set. All their notions were mechanical, their most favourite illustrations were just what I have stated, their whole doctrine was absurdly consistent, not with nature, but with itself ; and this doctrine has been the apology for all contrivers of machines, from the time of Hildanus down to Dr. Aitken and Mr. Gooch, the great mechanists of the present day.

We cannot wonder that medical writers have been fond of criticism, for the demolishing of an old doctrine is half the business of establishing a new one. But the exposing of a theory so ignorant and so dangerous as this, if it do not help us to a true doctrine, at least turns our minds vigorously towards the search of truth. In trying to understand the process by which callus is formed, surely we can compare it with nothing so properly as the original formation of bone.

The absorbent system is of more importance than is generally observed ; for while the absorbents have been represented as useful only in removing the excrementitious and spoiled parts of the body, in taking up extravasated fluids, removing tumors, or conveying away parts corrupted by disease ; these are, in truth, but trivial and occasional functions of the absorbents, which are the great means of forming, preserving, and indirectly of nourishing the system. The necessity

Nor is this the peculiar doctrine of the age in which Paré lived, it is the doctrine of the French Academy. We find in every page of their works such expressions as these, “ Un exemple singulier de l'effusion irregulier des *sucs osseux congelés en forme de stalactytes.*”

Pott continually repeats expressions of the same import, as, “ that callus is a particular juice circulating in the bones for their particular nourishment.” “ This callus or uniting medium,” &c.

* “ *Generatur autem callus ex ossis alimento, quod a labiis fracturæ exsudans circum ossa fracta con-
crescit. Et licet non sit os, ita tamen durum est, ut si membrum illud rursus frangi contingat,*” &c.

of a continual supply of food, implies an incessant waste and absorption; the parts must be taken up by the absorbents before they be replaced by the arteries. The actual materials of which the living body is composed are in perpetual fluctuation; all its parts are continually secreted anew; the secretion of the parts is expressly proportioned to the action of the absorbent system, which is ever making room for new depositions. While the parts of the living body are thus incessantly changing, the incessant change prevents any hurtful chemical process from taking place in the living body; it is this perpetual renovation of parts that gives the character of living matter to every coarse and common aliment which we receive into the system, and which is alternately assimilated and thrown off; the whole materials of our system are inanimate, yet the whole system is alive; motion, assimilation, and growth, distinguish living matter; and it is this perpetual change that gives to the inanimate matters which are assimilated with the system the properties of a living body. These processes, of incessant absorption and deposition, are turned occasionally towards the reproduction of lost parts; and it is this which we have to consider in trying to investigate the reunion or reproduction of any part whatever, whether separated and cut off by wounds, or killed by disease; for nutrition in health, and reunion, regeneration, and recovery from disease, are but various modifications of one process.

A bone is a well organized part of the living body; that matter, which keeps its earthy parts together, is of a gelatinous nature; the earth of bone, to which it owes its hardness, strength, and all its useful properties, is deposited in the interstices of this gluten, undergoing a continual change and renovation; it is incessantly taken up by the absorbents, and secreted again by the arteries. It is this continual absorption and deposition of earthy matter which forms the bone at first, and enables it to grow with the growth of the body; it is this unceasing activity of the vessels of a bone, which enables it to renew itself when it is broken or diseased; it is, in short, by various forms of one secreting process that bone is formed at first, is supported during health, and is renewed on all necessary occasions. Callus is thus a regeneration of bone, organized by the same action with that by which the original bone is formed. The callus begins to be formed after a fracture, as soon as the continuity of vessels is re-established, and their healthy action renewed. Bone is a secretion (as, indeed, the whole solids of the living body are but a secretion) originally deposited by the arteries of the bone, which arteries are employed in renewing it continually. It is not a concrete juice, deposited

merely for the occasion of filling up the interstice betwixt fractured bones, but a fair regeneration of new and perfect bone, with its needful apparatus of arteries and veins, and of absorbents, by which its earthy matter is continually changed like that of the contiguous bone. Callus, indeed, could hold no connexion with the contiguous bone, were it that inorganic concrete which was once supposed*.

Even after exchanging the old doctrine for a more perfect physiology, surgeons have continued still under this apprehension, that the slightest motion would disturb, or totally ruin a callus just about to form. But it is an ignorant fear, proceeding merely from not having observed the state of the parts; for, in truth, when callus forms, the perfect constitution of the bone is restored; the arteries pour out from each end of a broken bone a gelatinous matter; the vessels by which that gluten is secreted, expand and multiply in it, till they form betwixt the broken ends a well organized and animated mass, ready to begin anew the secretion of bone. Thus you may perceive, by the plainest induction, that the ends of the bones are, when the bony secretion commences, much in the condition of soft parts which have recently adhered; and it is only when there is a want of continuity in the vessels, or when want of energetic action incapacitates them from renewing their secretion, that callus is imperfectly formed. This is the reason why, in scorbutic constitutions, in men infected with syphilis, in pregnancy, in fever, or in any great disorder of the system, or where the wound of a compound fracture is still open, no callus is generated†.

It results from this doctrine, that callus is established in a renewed continuity

* How could we otherwise, than by this doctrine, account for the reproduction of bone, where large pieces are lost? Sometimes the wheel of a waggon squeezes out a piece of the tibia two inches long; or a part of a bone is destroyed by caries, and is exfoliated; or a piece of a long bone is boldly cut out by the surgeon. If, for example, three inches of the tibia, or of the radius, are thus sawed out, the other bone, the ulna, or the fibula, keeps the limb of its right length, the two cut ends do not approach each other; we see them healing by a spongy intermediate flesh; we see nothing but red, lively, bleeding granulations filling up the interstice; and when the cure is accomplished, we find that the secretion of bone is perfect, and the limb strong, and the new bone quite hard.

† A foot-note of Mr. Pott's is the best comment upon this assertion. "There is one circumstance relative to compound fracture which may, perhaps, be deemed worth noting, which is, that I do not remember ever to have seen it necessary to amputate a limb for a compound fracture, on account of the too great discharge, in which the fracture had been united. In all those cases where the operation has been found necessary, on account of the drain of matter, the fracture has always been perfectly loose and disunited. *Foot-Note to POTT's Treatise on Fracture, P. 474.*

of vessels; that a soft, flexible, and vascular substance is interposed betwixt the ends of the broken bones; that a sort of temporary gland is organized for the generation of bone, or, to speak not figuratively, but philosophically, it seems as if, by this reunion of all the adjoining parts, the original constitution and proper organization of a bone were restored. But for some time the secretion of earthy matter is imperfect; it is infant bone, soft, flexible, of an organization perfect for all the purposes of bone, but as yet delicate and unconfirmed; not a mere concrete, like a crystallization of a salt, which, if interrupted in the moment of forming, will never form; not liable to be discomposed by a slight accident, nor to be destroyed entirely even by a rude shock! Young and unformed callus is a substance soft and fleshy, so that it yields; ligamentous in its consistence, so that it is not very easily injured; and in its organization so far perfect, that when it is hurt, or the bony secretion interrupted, the breach soon heals like the adhesion of soft parts, and so the callus becomes again entire, and the process is immediately renewed.

But as this is a theory which is to have some influence on your practice, it must not be slightly treated; but must be supported with something more substantial than hypothetical reasoning. I shall proceed, therefore, to state facts.

Towards the end of the cure of a fractured limb, the patient becomes careless and confident, and often by his playing tricks with his crutches, or by the crutches slipping or breaking through his negligence, he loses his balance, throws all the weight of the body suddenly on the weak limb, and thus breaks it a second time. And here a phenomenon presents itself, which very strongly confirms our doctrine. It is, indeed, contrary to the vulgar opinion, but yet it is certainly true, that when a limb is broken a second time, it reunites more easily than at the first, and when broken a third and a fourth time, heals still faster and faster. A little girl, a daughter of Mr. Y. had her arm three times broken, and at each time I found it unite in a shorter period than the preceding. A young man, a servant with Mr. G. having broken his leg, it bent and broke under him three successive times, and at each successive fracture it healed more and more easily.

“An officer whose leg had been reduced by a French surgeon, and who was recovered so as to walk abroad, fell and broke it a second time, about the fiftieth day of the cure. The limb being reduced and laid again in splints, was so well ossified in twelve days, that the surgeon took off the splints, the pa-

tient was able to lift his leg; it bore its own weight quite easily, and by the twentieth day it bore the weight of the body; he walked abroad, used all manner of freedom, and was cured a second time, and by the twenty-fourth day he was able to walk without any other help than a cane. But this ill-fated leg was destined to be broken a third time; for, this gentleman having mounted his horse in order to go and join his troop, the first step of his journey was a very disastrous one! His horse plunged in among some clay, he fell, and the horse, in kicking to clear himself, broke both the boot and the rider's leg*. This third fracture was still more easily reunited than the second, for in less than six weeks he went to his regiment with the leg strong and firmly joined, and so accurately, that it was not easy to distinguish the broken leg from the sound one."

In all these cases the limb yields, it bends under the weight of the body, it is broken so that it can no longer support the weight of the body, but without any snapping or sharp splintering of the bone, and, in general, without any overshooting of the bones, and without crepitation. It is chiefly by the change of shape in the limb, by its bending somewhat, that you know it to be broken.

Every accident of such a case is perfectly consistent with the doctrine which I have laid down, and proves it very strongly. Callus is really more vascular than bone, and of this we are assured by various proofs. Having cut off the limb of a soldier, whose leg had been broken in America twelve years before, I found, upon injecting the bone, that while the bone itself received the red colour of the injection pretty freely, the callus, which goes in a zig-zag form, joining together the several ends and points of a very oblique fracture, was very singularly red. The callus, then, is more vascular than the bone which it belongs to, even at the distance of twelve years from its formation. This callus, unconfirmed at the time that it is broken, is soft, and very highly vascular. When the callus breaks, many of its vessels are ruptured, but some are only elongated, and it rarely happens that its whole substance is torn. You may easily imagine how much more readily the continuity of vessels will be renewed within the substance of the limb, when the bone or callus is surrounded by vascular parts ready to swell and close up the breach, than in any external wound.

* The meaning of the horse breaking the boot as well as the leg, will not be understood by those who are not acquainted with the peculiar manner of accoutering a bidet or hack-horse in France. It has two large fixed wooden boots, slung on each side of the saddle, and when the rider mounts, he thrusts his leg, boot and all into these wooden boots.

When we consider the perfect vascularity of a callus, its ligamentous toughness at the period of its being thus rudely bent; the excitement which must follow this partial rupture, and the full and vigorous circulation in vessels accustomed to the secretion of bone, we understand why a fractured callus is more speedily reunited than a broken bone, where nothing is prepared for the generation of new bone.

I think I cannot illustrate the condition of a callus, at the time that it is broken, better, than by comparing it with the condition of a bone, where, by the perpetual restlessness of the patient, a proper callus has been prevented, where the bones have covered themselves with a sort of cartilage, and an unnatural joint has been formed; where the surgeon makes an incision, turns out the ends of the bone, pares off the callus from each end of the bone, returns the pared ends of the bone again into their place, and lays them among the flesh, opposite to each other, and sews up the wound! then adhesion takes place, the communion of vessels from bone to bone, and also the continuity of all the surrounding soft parts, is restored; then all the surrounding vessels are drawn into action, a mass of parts, active and in high circulation, is formed round the broken bone, the blood and humours are worked towards it, and the vessels of the bone itself being thus supported in their new action, the ossific process is renewed with great energy. This is the result of an experiment, or rather of an operation, which has been several times performed, and particularly by Mr. Park of Liverpool, and is a fine analogy for explaining the condition of a fractured callus; for in proportion as the organization is advanced, and the parts full of blood and in high excitement, the second fracture is more rapidly re-united than the first.

This accident, of breaking the leg a second time, is in no case so grievous a misfortune as might be imagined; in a very ill reduced fracture, I should rather esteem it fortunate. It was the practice of surgeons in all ages, to snap the limb across their knee whenever they were ill pleased with the shape of it; and although, in the present day, such a practice would be esteemed a mark of the grossest ignorance, it is but one example out of ten thousand, where opinions which now pass only among the vulgar, may be traced to the highest and most respectable authorities.

That the ancients had very generally engaged in this practice, I could easily prove by direct authority; but, indeed, there can be no proof more satisfactory than what is to be found in the writings of those who were averse to the prac-

tice. "When a limb is unfortunately so united that it is crooked, knotty, and deformed, but still useful, you must by no means hearken to the advice of *those who direct* you to break it a second time; a thing which has been but too much practised in these countries (viz. in Arabia) by foolish physicians and bone-setters. The operation is dangerous, it is even fatal *."

One should have believed Albucasis, from these manly and determined expressions, to have been quite above such follies. But he has a beam in his own eye, while he is plucking the mote out of his brother's; for this same Albucasis is full of directions for softening, for paring, for chiselling, for sawing, and for rasping away exuberant callus, which sometimes he tries to soften, and sometimes to constringe by styptics. "Often (says Albucasis) the callus, especially when near a joint, is knobby, deformed, and even causes lameness of the limb. Then you are to consider whether the callus be recent; then you use styptics, aloes, olibanum, myrrh, and accassia, and prepare them with wine, vinegar, or whites of eggs; bind such an astringent firmly over the lumpy callus, and renew this firm bandaging and these powerful astringents till the protuberance be dispelled; or bind round it plates of lead, for lead is a metal very friendly to the human body †."

"If the callus have already concreted and become firm, and you be in haste to rid the limb of it, then make an incision, and rasp off the protruding part with saws ‡."

When Albucasis directs these operations merely for exuberant callus, we may well

* Quando accidit membro jam restaurato post sanationem ejus tortuositas, et eminentia ossi fracto, aut nodatio: et scædatur per illud forma membri, verumtamen membrum non prohibetur ab operatione sua naturali: tunc non oportet ut recipias sermonem ejus, qui existimat, ut frangatur membrum denuo. Et jam fuerunt multi stolidorum medicorum et restauratorum, qui fecerunt illud in terra nostra. Et hæc quidem operatio est vituperabilis valde, perducens ad mortem, vel timorem magnum, ut scilicet sit mortalis.

† Multoties accidit hæc nodatio in vestigio sanationis fracturæ. præcipue, quæ est prope juncturas: et scædatur ex ea figura membri. Et fortasse prohibet membrum ab operatione sua naturali. Considera ergo tunc, si nodatio est recens: administra in ea medicinas quæ stypticitatem habent. sicut aloë, et olibanum, et myrrha, et sarcocolla, et acacia, et similia eis. Ita, ut accipias ex istis quasdam, aut omnes eas: et confice eas cum vino styptico, aut cum albumine ovi, aut cum aceto: et pone eas super nodationem in stuppa, et stringe eas super ipsam stricture bona. Et dimitte stricture, nec solvas eam diebus multis. Deinde solve eam, et itera aliam, donec removeatur nodatio. Aut stringe super ipsam laminam plumbi decenter. Plumbo enim est proprietas removendi omne quod timetur ex membris.

‡ Si autem nodatio jam in lapidem conversa est, et stricta est, et festine provocat necessitas ad auferendum eam: tunc finde super eam ex superiori parte ejus, et incide superfluitatem eminentem: aut rade eam cum quibusdam rasoriis, donec removeatur: et cura ipsam, donec sanetur.

wonder what kind of operations he has in reserve for a lame and distorted limb. He repeats the same process; he does not, indeed, direct astringents, those are used only to repress the sponginess of recent callus; the confirmed crookedness of a deformed limb is to be overcome by soaking it in emollient fomentations of melilot or mallows, or it is to be softened with the mucilage of mallows, oil of sesamum, and cock's grease. But his last hope seems to have been in the pigeons dung, fat figs, and other medicines, termed among the Arabians, *Medecina Consolidationem Minuentes*, Attenuating Medicines, rubbed in with the warm hand*; but if these failed, he who would by no means break the leg, directs his pupils, "if the distortion be old and firm, to cut across the bone, and saw off all that is superabundant, whether of the bone or of the callus. Study and practice (says Albucasis) will make you very expert in the operation†." Thus the prudent and sagacious Albucasis, who would by no means hear the advice of these ignorant physicians and bone-setters, who advise to break the leg and set it anew, describes in various places how to saw or scrape, or cut away with saws or chisels, any unsightly callus.

If Albucasis be more particularly to blame, it is because what others recommended only, he absolutely performed; but the doctrine was as old as the science of surgery itself. These operations are servilely copied from the ancients by many modern surgeons; they have transcribed the very words from Paulus‡. In no

* Verum si claudicatio et nodatio sunt recentes: tunc oportet, ut embrocetur cum aqua tepida, in qua decoctæ sint herbæ mollificantes. sicut folia altheæ, et radix ejus, et mellilotum, et illis similia. Et fiat ei emplastrum cum emplastro mollificativo. sicut dyachilon decenter factum. Aut sumatur mucilago radice altheæ, et concutiatur cum adipe gallinæ, aut oleo sisamino: et emplastretur cum eo. Aut sumantur ficus pingues, et terantur cum fimo columbino, et similibus eis quæ nominantur ex medicinis diminuentes consolidationem. Et quandoque solvitur nodatio cum fricatione assidua, antiqua, et leni, quæ fit cum manibus humidis.

† Si autem tortuositas jam antecessit, et fortis facta est, et conversa est in lapidem, et provocata est necessitas ad curationem ejus cum ferro: tunc oportet, ut secetur superius ejus, et solvatur continuatio ossis, et incidatur quod superfluit ex nodatione aut ossæ cum incisoriis subtilibus: et administretur facilitas in illo cum sollicitudine et studio.

‡ Quibus membrum distortum callus firmaverit difficultate, functionis obeundorum haud exigua subsequente, presertim si in pedibus fuerit repositionis quidem modus videri recipiendus est, ut qui extrema inferat discrimina. Verum si callus nondum radices egerit luxantibus superfusionibus, et cataplasmatibus exsicis pinguibus et columbarum stercore aliisque medicamentis quæ a callo solvendo paralytica dicuntur utimur. Insuper per manus frictione et confractione hunc dissolvemus. Quod si lapidosus evaserit, scalpello superficie divisa excisoriis scalprii consortium ossæ liberabimus, deinde fracturæ medebimur, ut superius a me dictum est.—PAULI AB ÆGINETA, lib. vi.

age have furgeons forsaken this operation. Fabricius has recommended the breaking the limb anew, and La Motte almost in our own times has practised it. Fabricius says, "when the limb is lame, the patient young, the callus recent, the bone soft, there is but one resource, and that is to break the bone; but first try, for some days previous to this attempt, to soften the callus with embrocations of althea, mallows, and the medicated clays of St. Peter and St. Bartholomew, and then break the bone with your hands; but if these will not do, the callus being hard, then break it with instruments and heal it after the manner I have taught you *."

And in the next succeeding age, we find Heister not at all less explicit than Albucasis, Fabricius, or the ancients. He repeats verbatim the rules of Fabricius. He says, "if a fractured limb appear crooked and deformed after the cure, I know of no other probable method of restoring it to its former shape and beauty, than by making a strong extension of it and breaking it in the part where it is just united. This, however, is not to be done in the aged nor infirm, but where the callus is tender, and the patient young and vigorous, this operation may be fairly attempted †."

Nor was this merely a scheme with which speculative men only were delighted, it was a proper rule of practice, and they never omitted any reasonable opportunity of putting it in force. It was, I perceive at one period, so common an operation, that it looks indeed as if they had broken legs out of mere caprice. Here I cannot help remarking, that wherever there existed hot wars betwixt the bone-setters and the regular furgeons, this practice prevailed in a particular manner. The furgeons, by laying a leg across a stool or across the knee, and breaking it, taught the country people what sort of punishment awaited those who ventured to put themselves into the hands of professed bone-setters; and one example of this kind now and then served to keep a whole province in awe, and suppressed all petty treasons against the regular professors of surgery. But the bone-setters were not a sort of people to be easily outdone in this way. If the surgeon broke

* Ut si æger sit juvenis et robustus, callus recens, os fractum exiguum, unicum erit refugium fracturam de novo rumpere, ubi tamen prius per multos dies quantum fieri potest callum mollire debemus, perfusionibus ex althea et malvis salis thermalibus, D. Petri et D. Barthalomæi, &c. deinde rursus os frangitur *manibusve* digitis impelendo, sive comprimendo. Si callus fuerit durior, *frango* eum instrumento attrahente in diversas partes, deinde sano ut hæcenus docui.—FABRICIUS.

† Page 117.

legs of their setting when they looked clumsy, they knew in revenge how to bandage up legs with splints and rollers which were never broken, and so by setting their patients a-walking in a fortnight, they quite shamed the surgeons, who, when they reduced a leg, could not make their patient walk in less than two months * ”.

Men of the first eminence in our profession, the very best surgeons in the world have been in the practice of performing this operation. I was called, says La Motte †, to a young man of sixteen years of age who had the thigh bone broken seven or eight weeks before, and it was so re-united that he could not walk ; the broken thigh bone was shorter by half a foot than the sound one, and he called me in order to learn whether some sort of shoe might not be invented by which the leg might be raised so as to enable him to walk.

I found the bone broken about the middle of the thigh, the bones were so awkwardly joined that they absolutely crossed each other. There was a great elbow looking outwards, and a proportioned hollow within ; but the lad being young and healthy, and the callus as yet soft, I formed the resolution of setting the thigh bone again in its right shape by extension and counter-extension ; for I knew that the attempt could do the boy no harm, and I remembered from the accidental breaking of the callus, that the callus was long of obtaining its perfect consistence. So having made his bed and prepared bandages and splints, I made a powerful extension by the help of my young men, and pushed in this elbow with the flat palm of one hand, and resisted with the other. I succeeded perfectly to my mind, so that, without one cry from the lad, I reduced this angle, and made his fractured thigh as straight and as long as the other. In a month he was freed from his splints, and walked without pain or halting, while his thigh was as straight as an arrow ‡.

There is a rudeness and boldness in these old practices which we dare not imitate ; yet these are facts of which no surgeon should be ignorant, and indeed it is a matter which should be seriously considered, whether an oblique fracture will not

* Bone-setters and rib-twisters have been long a great nuisance in France, Germany, and Holland. Fellows who, every time a country man gets a bruise in his side, tell him his ribs are broken, and then pretend to thumb them into a right shape, or when he sprains his leg, bandage it up, and find means to convince him that it is fractured, and that the cure, and especially the perfect shape of the limb, is their own work.

† Page 193.

‡ Page 196.

be more easily retained of its due length, after the bones are rounded with a callus, and the surrounding parts all massed together, and so knotted by inflammation, as to support the edge of the bone, than when the fracture is recent, the broken ends of the bone naked and very sharp and pointed, cutting their way forwards among the lacerated flesh. It is to be considered whether La Motte did not accomplish, in this latter stage of the callus, what he could not have achieved in the recent fracture. Does not his report also give us a sort of assurance that the pain will be less even if we should venture to disunite an incipient callus, than when we extend a leg recently fractured and highly inflamed?

I know how strong the common prejudice is, and that these will hardly be received as conclusive proofs of callus being little injured by occasional motion. Notwithstanding the clear history of these facts which I have just delivered, it may be alleged, "that the wild and ignorant notions of Albucasis, or the learned and Gothic credulity of Fabricius, or even the rude and bold enterprises of La Motte and his contemporaries, are all but slender arguments for supporting a new doctrine." But the doctrine stands not upon any ambiguous proofs. I could demonstrate to you, if it were worth your knowing, that every surgeon, from the days of *Celsus* downwards, had been in the practice of extending the leg, and so extending the callus and putting it right when at any time he thought it wrong. This unquestionably is true, that if a man will not suffer his limb to be at rest; if, like the street porter mentioned by Palfin, he will not refrain from carrying burdens though his arm be broken; or, like the shoemaker whom I have mentioned, will not leave off working at his trade, though the radius and ulna be fractured! there is no question, that such incessant and violent motion will destroy, from time to time, all continuity of vessels, and absolutely prevent the formation of a callus. But there is nothing more certain, than that the extending a callus gradually, regularly, and gently, from time to time, will not harm it.

In the fracture of the thigh, where the muscles are powerful, and where all the ingenuity of the profession has never yet been able to prevent retraction and shortening of the limb, while some have put garters round the ankle and tied them to the foot of the bed to maintain a permanent extension, others have chosen to allow of that occasional contraction which they were sensible they could not entirely prevent, being careful only to renew the extension from time to time; and if those who judged in this manner had the boldness to extend the limb

anew every day, or at every dressing, or every twelve hours, then we may be assured of one of two things, either that such extension does not injure those vessels which are gradually forming and perfecting the callus, or that a leg so maltreated could never reunite.

Mr. Foubert of the Royal Academy of Surgeons of France, laments the impossibility of keeping up any permanent extension on account of the excoriation, swelling, and intolerable pain which such bandages excite. He was sensible that he could not prevent the limb contracting, but he was careful to extend it from time to time. He laid his patient upon a hard and firm made bed; he put a napkin, or other bandage, under the pelvis and round the groin, by which an assistant made resistance (or counter-extension, as it is called in technical language), while he himself extended the leg by a rack or bandage put round the ankle joint. The moment the limb was extended, the patient was relieved; but the relief lasting but for an hour, the limb contracted and required to be extended again; and Mr. Foubert *renewed this extension every twelve hours*, if necessary, for the first twenty days; but after the twelfth, fifteenth, or twentieth day, the callus becoming firmer, he found no longer any occasion for extending the limb *."

Parée, more rational and moderate in his manner of extending the leg, advises the surgeon to be careful at each dressing, that is, every third or fourth day, to compare the length of the broken limb with that of the sound one, and to be careful in extending and reducing the limb before the callus fixes, lest the patient should halt when cured †. I think there is even reason to believe, 1st, That in cases of desperate and oblique fractures, those limbs have been least deformed which have been most frequently broken. 2^d, That a limb ill set, fractured again by chance while the callus was soft, and set a second time, has been preserved more nearly of its due length than it could have been if set immediately after the accident, and allowed to heal without interruption. 3^d, There is also reason to believe, that those surgeons who have used the permanent extension with most success, those I mean who have kept the leg continually extended by bandages fixed to the head and to the

* On est quelquefois obligé d'avoir recours au même procédé toutes les douzes heures, pendant les premiers jours du traitement; mais passé douze, quinze ou vingt jours on n'est plus aussi souvent dans cette nécessité.—FOUBERT, p. 645.

† Partant, faut à chaque fois qu'on l'habille avoir égard à la figure de l'os et conferer la longueur de la jambe saine à celle du côté malade et auparavant que le callus soit fait le tirer et reduire, en sort que le malade ne demeure boiteux, et que le malade se remue aussi le moins qu'il pourra.

footboard of the bed, have succeeded, not as they imagined by supporting an unceasing tension of the leg to the same exact length for six weeks or two months! that were impossible! It seems to me more likely that the lacks and bandages have relaxed from time to time, that the joints of the limb itself have yielded, that by this yielding the apparatus has been loosened, and the patient has lain more easy during the night, that the surgeon in the morning has extended the limb again, and regained by this new tension what had been lost during the afternoon and during sleep; and thus what authors have called a permanent extension, seems to me rather to consist in successive reductions of the limb like those of Mr. Foubert. I believe, therefore, that Mr. Foubert, who rejected these extending bandages as a useless cruelty, obtained exactly the same advantages by occasionally extending the leg, that those have done who have pretended to support a permanent extension. I am confirmed in this opinion by remarking that Heister, who used the bandages fixed to the head and foot of the bed, did not so much regard those bandages as means of permanent extension! He considered them rather as lacks fixed for the purpose of occasional extension, and therefore he directs the limb "to be extended anew every time it contracts during the cure."

Those who, in consequence of accidents, have had their limbs set again from time to time (the bones having slipped past each other), have had the limb straighter and longer than those who have had the limb set once for all, and not unbandaged till near the end of the cure. Those limbs also have been least shortened which have been set, and disturbed and set again. Thus Paræus, who did not believe that there was really such an accident as a fracture of the neck of the thigh bone, being called to an old lady who had, by a fall, injured the haunch joint, found what he imagined to be a luxation. It was the shortening of the leg that made him imagine that the hip was luxated, and when he felt the great trochanter high upon the hip, he imagined that to be the head of the bone. He extended the limb till he thought he had pushed the head of the bone into its socket, and brought the two legs to be of equal length, and then applied his spica bandage. But two days after, upon visiting the lady, he found her complaining of great pain, and her leg was shortened again, and it was then only that the limb was properly set. This leg reduced at the distance of some days from the accident, and extended from time to time was cured without shortening.

Hildanus too, having set the thigh bone of a little girl of eight years of age,

the thigh contracted again on the fourteenth day, the bones passed each other, and the thigh was shortened, yet this is the case in which Hildanus succeeded the best! He made a perfect cure; and indeed upon mentioning the cure, he breaks into solemn exclamations of thanksgiving, with many expressions of gratitude to him that made us, which, even amidst his antique language, must, to a modern surgeon, seem particularly antiquated*.

I hope that by these facts and reasonings I have sufficiently proved to you, not only that callus is not a chemical process, an inorganic concrete, which being disturbed in its time of concretion will never form, but also that callus considered as the rudiments of new bone, though delicate, is flexible, and though it may be hurt by rudeness, cannot be destroyed! That when the cure is interrupted, even by an entire fracture of the callus, the process is easily renewed! that it is not every slight disturbance that will disappoint us of a cure; that those accidental movements of a broken limb which alarm the patient, or even give him pain, and which he reports with great earnestness and anxiety to his surgeon, are yet of no importance. You perceive with how little reason the justly celebrated Dessault says, "That it is a principle *which will admit of no controversy*; that to effect the re-union of fractured bone nature requires, not merely that the fractured ends be approximated, but that the limb be *preserved in a state of absolute rest*." This incontrovertible principle he makes the rule of all his practice, may I be allowed to say it, of all his cruelties; for this he derides, (and forbids in the most absolute terms), the practice of laying out a limb easily upon a pillow. It is about the practice rather than the theory that I am apt to be concerned, and I doubt not you will be able to forsake the authority of a great name, wherever you feel yourselves supported by the paramount authority of reason and facts.

But what need is there of such proofs, have not surgeons continued bandaging fractured legs with rollers, down to this very day; and does not the surgeon every time that he rolls the limb, which is, by all the rules of surgery, every third day,

* Hildanus remarks one thing very singular, very consistent with all the doctrines which I have delivered, and which I would be sorry to pass over in silence. He observes, "that though the thigh was greatly and suddenly shortened, fully three inches, and with a great protuberance, yet it was accompanied with no degree of pain; such as might be expected from the exquisite sensibility of the periosteum. *Extuberantia tamen hæc sine dolore ullo fiebat qua de re forsan admirari poteris cum periosteum exquisitissimo sensu sit peditum et proinde dolores gravissimos excitet si ab ossibus fractis pungatur.*—HILD. Obs. 86.

does he not move the callus? he would be a cunning surgeon indeed who could cure a broken limb by rollers and splints, if a slight motion could discompose the callus. If then the old doctrine of callus, being easily discomposed, be so plainly a mistake, what can be more absurd than the old practice? While the re-union of vessels and generation of callus in a broken bone, is so fairly analogous to the inosculation of vessels and the re-union of surfaces in an open wound, nothing will injure callus which will not hinder any other adhesion. Motion will not so easily affect an incipient callus, (surrounded as it is with adhering parts), as the adhesion of a superficial wound, which has nothing but stitches or plasters to support the parts. Callus is not a juice! it is not an effusion from the ends of the broken bones! Callus has no analogy with molten lead! nor the setting of gypsum! nor the hardening of stalactites, nor any other concretion! could motion discompose callus, as it prevents other concretions from hardening, no broken bone could ever heal.

From this history, you observe I draw no rash conclusions. I do not propose to break limbs when they are almost healed, that they may heal faster; nor to take even a crooked and unserviceable limb and lay it across the knee like La Motte; but I do with perfect confidence advise you, to leave off bandages, which you see were originally designed for no other use than to mould and fashion the callus; to reject those long compresses which were bound so firmly round the limb for the same purpose; to use such splints only, as when laid along the whole limb, may serve to maintain its posture and preserve it steady, and to tie those splints slightly with tapes; to lay out a broken thigh, (since it cannot be commanded by splints), smoothly upon a pillow, and to venture, without fear of hurting the callus, to extend the limb anew, and lay it straight when it is disordered and shortened. In a simple fracture of the leg, it is almost sufficient to lay it on a pillow; and you have done every thing when you have laid it lightly and easily in a smooth splint of pasteboard, then the patient himself is almost able to keep it right. In fractures of the arm, the part hangs naturally in the best posture, and requires but two splints of thin pasteboard, rolled gently with a linen roller; and in fractures of the fore-arm also, the limb preserves its natural length and natural form; it requires merely to be laid upon a long splint of pasteboard with a smaller splint laid above, the two splints secured with slight tapes or ribbons, and the arm slung round the neck.

Dismiss, then, those anxieties about the manner of rolling, and the express de-

gree of firmness which the bandages should have, look no longer thus anxiously at the points of the fingers or toes, to see whether the bandage presses properly so as to make those parts swell; you are not to draw the roller so as to straiten the limb up to the very point of producing gangrene, nor to use any bandages that are formidable from their straitness, nor any that are even firm, except in children, in drunken people, in maniacs, or in those who are delirious with fever or pain.

DEFINITIONS OF THE VARIOUS SPECIES OF FRACTURES.

Having corrected some prejudices, and initiated you into the history and theories of this interesting subject, I propose next to lay before you the various characters and distinctions of fractures. The formal distinctions of the schools we must endeavour to unlearn; for in the old surgery, fractures were distinguished rather by their form and other trivial accidents, than by the essential circumstances or peculiar dangers of the case. The ancients distinguished fractures into oblique, transverse, and longitudinal, according to the direction in which the bone chanced to be broken. They called a fracture Incomplete, when, of two bones, as the Radius and Ulna, one only was broken; Complete, as when both bones were broken, both Radius and Ulna, or Tibia and Fibula, or where there being but one bone, as in the arm or thigh, that bone was broken. They called a fracture Simple where there was no wound of the skin, and apparently no splinters of bone, and they called it Comminuted Fracture, when, though the skin was still entire, it could be perceived by handling the member that the bone was broken, or as they chose to speak, comminuted, crushed into small pieces. This was what Duverney called compound fracture. But I would allow of no distinctions so trivial, so perplexing, favouring so much more of learning than of knowledge. I would have useful, practical distinctions, or none. These distinctions of the old surgeons were made at a period when men delighted in no other kind of learning; they have no relation to the treatment of any case, and should not occupy a mind, which should be filled with more important considerations; for there are certain peculiarities in each case which determine the safety or danger of the patient, and even the peculiar treatment, and these are, doubtless, the circumstances you should learn to dwell upon.

First, *Simple fracture* is that in which the bones, though broken, do not protrude. The soft parts, though inwardly torn, are but little injured. The periosteum is not

separated in any remarkable degree from the bone; but the periosteum clings to the bone, the tendons and muscles to the periosteum, and the surrounding soft parts are so compressed around the fracture, in consequence of the limb being entire, that adhesion soon takes place among them! The interstices are filled with a gelatinous effusion which soon becomes organic, and the continuity of vessels is immediately restored. Even in a comminuted fracture, each little piece of bone retains its connexion with the soft parts, and lives, and is nourished, and reunited with the bone to which it belongs, so that when we dissect a fractured bone in the first days, we find the periosteum thickened like soaked shammoy leather, the soft parts massed together by inflammation, and the secretion of bone beginning in separate points; and when we dissect an old fracture, we find little pieces and splinters perfectly consolidated into the callus which had been entirely separated from the bone. This case, then, requires nothing but ease and quiet, and a favourable posture of the part. The cure may be resembled to the adhesion of an open wound where there is immediate reunion of vessels, no suppuration, no waste of parts, no remaining mark of injury, there is a spontaneous and perfect cure. The cure is spontaneous, the work of nature alone! the surgeon has nothing to care for but the form of the limb, to lay it even at first and to redress its posture when it happens to be disordered.

Secondly, *Compound fracture* is that where the fracture is accompanied with an outward wound, and it is called Great Compound Fracture when the bone protrudes. And in this case the flesh is often cruelly mangled, and the bone shattered into many pieces, and yet the parts retain (though not always) their life and vigour. The protrusion of the bone makes a rude and lacerated cut; the soft parts, as the periosteum, muscles, and skin, are all cruelly mangled, but they are not destroyed; the periosteum still clings to the bone, the muscles to the periosteum, and the skin to the muscles; there is a very shocking outward injury, but there is happily no proportionate disorder of the inward parts. The inward parts are lacerated and wounded by the protruding bone; they are hurt by the violence (as the crushing of a chariot wheel) which caused that protrusion; but they are still alive, still adhere to each other, and give mutual support; no part is so entirely killed, as by its death to draw on the death of the whole. But then these parts, though not killed nor separated from each other, are so torn that they seldom reunite; they run into inflammation, and the cellular substance is so filled

with extravasated fluids, and the bones so crushed, and reunite with so much difficulty, that the suppuration is very profuse.

The case, then, which is here defined, is a compound of fracture with a great suppurating wound not void of danger. The gorged vessels are soon unloaded by a free and timely suppuration; after the first swelling subsides, the parts become flaccid, the matter profuse, the patient is in danger of being exhausted with pain and fever, and the dangers of the case are chiefly those of a great suppurating wound! If we are forced at any time to amputate such a limb, it is only for want of strength in the patient to support the pain, fever, and profuse discharge; for through time and care the lax swelling subsides; the suppuration lessens in quantity; the loose bones are discharged; the living bones (whose periosteum still adheres to them), though broken in a way seemingly destructive of all organization, recover their connexion with the fractured bone, in a manner which has long been admired. Of the bruised parts, those which lie deep come to be pressed into contact with each other; the vacant spaces within and the external wound are filled with granulations, and then the continuity of vessels is restored, and the callus is completed. This continuity of the vessels is essential to the regeneration of the bone; and we see the reason of a phenomenon which has excited the surprise, not only of Dr. Hunter, but of all surgical writers from time immemorial, viz. that during the suppuration, and while the wound continues open, no callus, or at least, no complete callus, ever forms.

Thirdly, In COMPOUND FRACTURE AND LUXATION where, along with the protrusion of the bones, there is a laceration of ligaments, tendons, and capsule of some great joint, the case is peculiarly dangerous. When, for example, the ankle joint is burst up, the astragalus broken to pieces, or turned out through the wound, the lower end of the tibia shattered and protruded, and the fibula also broken, the disorder is such as to defy the powers of nature, and art can do but little. This is of all cases the most perplexing to the judgment, and distressing to the feelings of the surgeon, who often wavers in fear and anxiety, for some days desirous of saving the limb, and yet fearful of losing the patient's life, till at last the fatal gangrene appears, and he feels most poignantly the fault he has committed, if, indeed, the surgeon can be said to have committed a fault who has attempted to save a man's limb, though at the risk of his life. Yet the surgeon, though he have acted deliberately, conscientiously, sensibly and humanely; though

he has been supported by the countenance of his fellow surgeons; still, when misfortune comes, must feel himself unhappy.

The French surgeons, with one accord, declared amputation to be in such cases the only chance of saving the life. Palfin says *, " In luxations of the ankle, there is seldom any thing to be done but amputation." The same is laid down by Duverney †, as an express unconditional rule of practice. We do not comply with any such barbarous rule, we take it only as a denunciation of the danger which is observed to attend this particular case; we keep our minds free and unbiassed, so that we may be able to decide this question according to the circumstances. We know that nature will do wonders, but they are wonders, and we never enter upon the attempt of preserving a limb thus desperately fractured, without awful hesitation, and when we do venture to dilate the wound and push back the bones, we feel all the responsibility of what we have just done. We watch the appearance of mortification for some days, and wait with inexpressible anxiety the natural issue of the case, life or death.

Thus the simple fracture terminates in adhesion of the parts inwardly bruised and injured; compound fracture ends sometimes in adhesion, but more frequently in suppuration of parts too much bruised to adhere; but the fracture of a great joint, as of the ankle, is attended with lacerations too terrible to adhere, or even to suppurate easily; this is the case which while it sometimes suppurates is most apt to terminate in gangrene and death.

Fourthly, *Gun-shot fracture* has many dangers peculiar to itself; and of all those circumstances by which, in other fractures, the soft parts recover their healthy condition, and the splinters regain their natural connexion with the bone, not one can take place in gun-shot wound: For here there is infinite loss of substance! the bone is not merely broken, it is destroyed, contused, and deadened by the blow, and condemned to the absolute exfoliation of every individual particle and splinter that has been shaken by the ball.

From the moment in which the bone is struck by a ball, it loses its life and circulation, and all its connexions with the soft parts. The bone is deadened to some extent by the force of the blow; it is splintered into many pieces; the periosteum too is killed by the shot, so that of the injured or splintered pieces, not one can recover its life or resume its connexion with the living system.

Nor is the bone only killed, but all the surrounding parts also, for the bone is

* Page 184.

† Page 157.

the resisting body which, by receiving the force of the ball, reverberates it upon the adjacent parts, so that that portion of the flesh which most immediately surrounds the bone, is particularly affected, is deadened, and thrown out in the form of sloughs.

These are the accidents of this species of fracture which distinguish it from all others; for the death of all the internal parts insulates the broken bone. There can be no adhesion among parts which are actually dead, the continuity of contused vessels can in no shape be restored; instead of a knotting of the soft parts into a vascular mass, full of life and action, supported by a continuity of vessels, and fitted for the generation of callus! there is a cavity full of foetid matter, dead and sloughing flesh, and insulated fragments of bone! a narrow opening, a deep and ill-conditioned wound, and a profusion of foul and putrid ichor flowing from the narrow openings, or bursting through various fistulas from time to time.

Thus, a gun-shot wound with a great fracture, resembles in many points the worst kind of caries. The detached bones are discharged with difficulty; the dead parts which have sloughed off, are very slowly replaced; it is long before the wound begins to heal from the bottom, or, in other terms, before the continuity of vessels is restored, or the mass of vascular substance prepared, in which the callus is to be formed. In short, the parts are with difficulty regenerated; they are slow to heal; apt to run into ulcers, fistulas, and collections of matter; while the patient is exhausted by pain, fever, and profuse discharge.

Having thus explained to you the general nature of a gun-shot fracture, I believe you can be at no loss to imagine the peculiar difficulties of each case, for where the limb that is wounded is small, there is less destruction of parts; the sloughing is not great, the suppuration is slight, and the bones being near the surface, the shattered fragments are easily discharged. Thus it is in wounds of the radius and ulna, and of the os humeri.

But where the bone is greater, the mass of soft parts more bulky, the wound of course deep, and the destruction of parts proportionably great, the matter is apt to insinuate itself among the muscles, to insulate the bones, and to make in the end crooked and fistulous passages, and an almost incurable sore. Such are often the consequences when the bones of the leg are broken, especially where the joints of the ankle or knee are concerned.

But where the bone is the largest in the body, and covered with a great thick-

ness of flesh, as in the thigh, there is a very extensive destruction of parts, the mass of disease is very great, and if the patient escape gangrene in the first days of the wound, he generally perishes afterwards from the fever, the incessant suffering, and profuse discharge. From a gun-shot wound in the haunch bone, or in the femur, near its neck, about the trochanters, or any where high in the bone, not one of twenty escapes. The sufferings of such a person may be easily imagined, since he lives, or rather one might say, continues dying for five years, and while he lies on this bed of torture, with matter running in profusion from various fistulas every where surrounding the joint! irregular callus shoots out in fantastic forms round the bone, so as to unite the bones in that crooked form in which he lies; yet even while the callus is thus forming, the fistulas being incurable, and the discharge profuse, amputation is impossible, and the patient expires.

DISCOURSE XIII.

ON THE ANATOMY AND ACCIDENTS OF THE HIP JOINT.

"IN MIRABILI ARTICULATIONE FEMORIS CREATOREM ADORAMUS."

BOERHAAVE.

It is not alone on account of the lameness and misery which so often follow injuries of the hip, that we take a lively interest in the subject. There are difficulties in distinguishing the various affections of this deep lying joint degrading to surgery; every individual feels at times as if he were alone responsible for the general ignorance, and accountable for that lameness which is declared to be inevitable. They are difficulties which all ranks of our profession complain of, which I cannot but feel, yet it is the subject which I must now endeavour to explain.

To what cause shall we ascribe this uncertainty? surely to careless studies and indifference, to anatomy, to ignorance of the form, or, at least, to an imperfect conception of the nature of the joint. Many have been made unhappy for life by this prepossession, as criminal almost as it is ignorant; "that to distinguish the disorders of this joint is impossible, that to feel for its injuries is an unmeaning cruelty; in one word, that lameness is inevitable!" Formal scholastic unmeaning distinctions have been long repeated as substantial knowledge; and explanations, which have no relation to the structure of the joint itself, praised as important theories. The joint has been described as composed merely of bones, and well are they who understand even the bones! but to consider it as a compound articulation, to regard the bones as endowed with living powers, as parts formed and supported by vessels, growing along with the body, and, like the rest of the body, subject to decay and injury! to observe the soft and glandular parts which facilitate the motions of the joint, and to regard the whole, the bones, periosteum, ligaments, and glands, as alive, subject to the usual changes of the living body, and to all the varieties of disease! is a flight beyond the usual education in

philosophy of young men who learn merely the form of the naked shaft and processes of the bone, and know nothing of the living properties of the bone, of that system of active vessels within itself, or of vascular connexion with the surrounding parts, which can alone explain the nature of its diseases.

There are no doubt cases in which the errors of the surgeon are more immediately fatal than in the injuries of the hip joint, but in none do his mistakes render the patient so truly unhappy. If a bruise of this joint be neglected, if a luxation be misunderstood, the patient becomes irrecoverably lame, and every day of his life he is reminded of his misfortune by pain and fatigue. We observe numbers in the street whom we pity, even from the apprehension of what they suffer; perhaps many of those might have been saved from this mortifying and miserable situation; surely the frequency of this kind of lameness should be alarming to every surgeon.

If there be any subject universally acknowledged to be at once interesting and difficult, or upon which we should naturally enter with an impression of its importance, it is this; the natural connexions of anatomy and pathology, of cause and effect, will, I believe, appear more and more obvious and important as we proceed in the inquiry, yet it is a subject which should be opened with the most perfect simplicity, and on this account I bespeak your attention to the following description of the hip joint. The student may be insensible to the value of this lesson, but the established surgeon soon begins to count his years by his disappointments, and those who have had the most experience, will be the most ready to acknowledge, how frequently, and how unhappily they have struggled against those very difficulties which are the chief subject of this discourse.

GENERAL ANATOMY OF THE HIP JOINT.

The hip joint has to bear the whole weight of the body, and of occasional loads, nor is there any joint in all the body (not even the vertebræ of the neck, nor the hinge of the knee itself excepted), which has a more continual motion. There is no turn of the limbs nor inclination of the body which does not produce a corresponding motion in this joint. When the body being erect, we bend the trunk, there seems to be a motion in the vertebræ, while it is merely the pelvis rolling upon the top of the thigh bone. When we turn the toe, even in the slightest degree

inwards or outwards, though there seems to be a motion in the foot, there is actually none ; the ankle and knee are rigid, and the corresponding movement is at the top of the thigh. Even when we lie along in bed, there is no movement of the limb, no inclination nor change of posture in the body, however slight, which does not affect this joint ; those who have the hip joint injured lie as still as in the grave : In short, the slightest motion of any part of the body moves this central articulation, and produces the most horrid pain ; the pelvis, in the ordinary motions of walking, rolls continually upon the top of the thigh bone ; and those who have the thigh bone displaced from its socket, in whom the weight of the body is not supported by the bone, but hangs by the soft parts, feel how entirely this joint supports the weight of the trunk, and is, as it were, the centre of all its motions. The knee does, indeed, like the hip joint, support the whole weight of the body, and equals it in strength and firmness ; the knee is also secured by strong internal ligaments, and is lubricated with many mucous ducts, but it has only one motion to perform ; it is a mere hinge ; it bends, but does not turn. In short, no joint of the body is at once so large, so firm, so steady, and yet so free in its motions, as that of the hip ; the knee and ankle joints support the whole weight of the body, but they are merely hinge joints, moving only backwards and forwards ; the hip joint alone, while it bears the whole weight of the body, moves, at the same time, in all possible directions ; and yet its movements, though continual, are so easily performed, that we are insensible of them till the joint is inflamed, when every motion gives excruciating pain ! or till it is ankylosed when not only the limb is distorted, but the whole person deformed !

In the shoulder, the glenoid cavity or socket for the bone is shallow, the head of the bone is flat, there is no neck joining the head to the shaft of the bone ; and the capsule of the joint is extremely thin ; it merely contains the lubricating liquor, but adds nothing to the strength of the joint. In the knee the heads of the bones are absolutely flat, and are merely laid upon each other ; there is no socket for receiving a round head, nor head to be so received ; the capsule of the joint is transparent at the sides of the patella, and as delicate in all its circle as a common bursa mucosa ; while the internal ligaments are placed not in the centre of the joint, but at the back of it, for it is merely a hinge, whose internal ligaments regulate only its flexion and extension. But in the hip joint, all the provisions for firm, steady, and, at the same time, easy motion, are very perfect ; thus,

1. The ACETABULUM or socket for the thigh bone is deep, large, circular, very

solid, hollowed out of the largest bone of the pelvis, which is of course the largest and steadiest bone of the trunk ; while the head of the thigh bone is very big, of a regularly spherical form, and is inserted deep into this socket, the whole head of the bone being covered by the cartilaginous borders of the acetabulum.

2. The thigh bone is the only bone in the body which has properly a NECK, which is long and oblique, and sets off the shaft of the bone from the socket, so that the high shoulders of the thigh bone do not, even in its widest motions, encounter the back of the haunch bone. The shoulders or processes of the thigh bone, named TROCHANTERS, are very large, to receive many powerful muscles which are implanted into them for the purpose of managing and turning the limb ; and these rotatory muscles turn the thigh bone upon its axis, preparing the limb for every new step, steadying it when the step is made, or bending and inclining the trunk upon the top of the thigh bone, when the limb is fixed by the weight of the body.

3. The CAPSULE of this joint is singularly firm, it does not merely contain the synovia, but gives strength to the joint : while other capsules are as thin as air-bubbles, this is in some parts nearly half an inch in thickness, hard and firm, it is, indeed, at its fore part almost cartilaginous ! and it needs to be thus firm, for the long neck of the thigh bone prevents the great muscles being implanted (as in the os humeri) close upon the head of the bone, so as to support the capsule.

4. The CENTRAL LIGAMENT is truly in the centre of this joint ; it arises from the bottom of the socket, and is implanted into the very centre of the head of the thigh bone ; it is strong and firm, and holds the bone firm in its place ; for this is a joint which moves freely, all its motions are rotatory, and this ligament is in the very centre of its circular motions.

5. The MUCOUS FIMBRIE, which lubricate the bones to facilitate their motions, lurk in the centre, or rather in the lowest part in the bottom of the socket ; they are naturally connected with the central ligament, they are grouped round the root of it, and of course are moved with every motion of the joint, giving out their mucus in proportion to the degree of motion.

OF THE ACETABULUM OR SOCKET.

The acetabulum or socket for the thigh bone is formed in the centre of the greatest and firmest bone of the pelvis, named os innominatum, from its irregu-

lar shape. It is in the adult the largest and firmest bone of the pelvis, but in the child it is formed of three distinct bones, the Ilium, Ischium, and Pubis. These are joined by an intermediate cartilage, and are easily separated into distinct bones. At an early age this cartilage is prominent, and somewhat of a triangular form. The cartilage is ossified in the adult, and it being ossified, becomes more prominent, and makes a high triangular projection in the centre of the socket; this prominence gives a firmer connexion to that thin cartilage which lines in a more general manner the cavity of the socket; it is here also at this prominence in the centre of the socket that the central ligament is fixed, which, although it is named the round ligament, is (especially at its root) of a triangular form. The bones, which compose the acetabulum, are not inseparably joined even at the twentieth year; it has been affirmed, that by a violent blow on the trochanter, driving the head down into the acetabulum, those three bones have been burst asunder! I strongly suspect that it is the imperfect ossification in the centre of this joint that makes the acetabulum so often in boys the seat of disease.

The socket is of a fair circular or cymbal-like shape; from its resemblance to a small cup in which vinegar was measured by the ancients, it is named ACETABULUM; it is deep, and entirely receives the head of the thigh bone; its borders are cartilaginous, project beyond the bone, and deepen the cavity. Its upper part, where it is formed by the Os Ilium, is both the deepest and the strongest part of the socket. Here the thigh bone is deeply lodged; upon this point, in the perpendicular posture of the body, the whole weight of the body rests and moves; and when a person falls from a height and lights perpendicular on the feet, the weight of the body, the impulse of the fall, the additional weight of a burden (if the person is loaded), bears altogether upon the neck of the thigh bone, and it breaks across.

The lower border of the acetabulum is very differently formed; at the lower part of the socket no weight is sustained; the head of the thigh bone is very superficially lodged; the socket is not even formed of bone, but there is a gap in this part of it filled up merely by ligament. It is necessary that so large a joint should have a lubricating apparatus, it is necessary also that the lubricating fimbriæ should be liberally supplied with blood-vessels, and this is the opening in the socket at which vessels can most conveniently enter free from the pressure of the bones. For this reason there is an opening in the lower part of the socket which looks towards the Pubis and Thyroid hole; the bone is wanting

for some space ; a cartilaginous ligament supplies the place of bone, and the vessels creep under the ligament into the bottom of the socket. It is from this necessary defect of the socket that luxation downwards, though not more frequent than luxation upwards, is produced by slighter causes.

OF THE HEAD OF THE THIGH BONE.

The HEAD OF THE THIGH BONE is quite peculiar in its form, and is the only true example in the human body of the ball and socket joint ; for the head of the humerus, though circular, is a small segment of a very large circle, while that of the thigh bone is a very large segment of a very small circle ; the head of the shoulder bone has less than one third of a circle, the head of the thigh bone has more than two ; in short, the one has the properties of a flat surface, the other of a completely circular head received into a cavity proportionably deep. The head of the shoulder bone is merely laid flat upon its glenoid cavity, while the head of the thigh bone is entirely received within its acetabulum, so that the borders of the cavity touch its neck.

The NECK OF THE THIGH BONE is in all respects the most important part. The peculiar length of the neck of the thigh bone is essential to the free motion of the joint ; it sets off the trochanters from the sides of the pelvis, and allows the shaft of the bone to turn freely. The neck of the femur is the only bone which bears its burden in an oblique and unfavourable direction, and it is placed obliquely, that each thigh bone may alternately bear its just share of the general weight. When we stand up, the neck of each thigh bone bears its weight obliquely in a less favourable direction, but then each thigh is equally loaded. When we move, when we make a step and incline the weight of the whole body upon one thigh bone, this thigh bone stands in a new posture with regard to the trunk and pelvis, the head of the bone looks directly upwards, and the neck of the bone is almost in the direction of the shaft ; but so curiously does the angle of the neck change with the posture of the body, that in proportion as the weight of the body is inclined to one or other side, the neck of that thigh bone, which bears a greater proportion of the weight, comes more into the direction of the axis of the body. The neck of the thigh bone, while it bears its weight obliquely, is at the same time the smallest, the weakest, and in all respects the most imperfect part of the bone.

The head of the thigh bone is united with the neck by an intermediate cartilage, the head and neck are not firmly united till the twentieth year, and sometimes in boys the head is separated by violence from the neck of the bone, producing a kind of fracture, named by the French authors, *Decollement*. More frequently it happens that the fracture is in the neck itself, especially in old people, for the neck of the thigh bone becomes thin at the approach of old age. But in the prime of life, when the thigh bone is broken with great violence, the fracture consists neither in a separation of the head from the neck, nor in a transverse fracture of the neck itself, but often the very thickest part of the bone, the root of the trochanters is broken so as to make necessarily a very irregular and clumsy callus.

OF THE CAPSULE.

The CAPSULE of the HIP JOINT is at once delicate and strong, delicate in its internal surface or lamella, but very strong in its external lamella. There is a reduplication of the membrane lining the socket, which it is of some importance to remark, for it appears to me that this capsule consists of two lamellæ, of the membrane lining the socket, and of that which covers the haunch bone, both meeting at the edges of the acetabulum so as to unite there. Of these two lamellæ, the outer one is singularly firm, thick and hard, it proceeds from the external periosteum, is strengthened by adventitious ligaments, and especially by a band of ligament which descends from the lower spinous process of the Os Ilium; the tendon of the rectus femoris also takes its origin from the fore part of the capsule, and the capsule is at that part singularly thick, indeed it is hardly at any part of its circumference less than half an inch in thickness, and is of a gristly hardness, so that it crashes when cut with the scissors or knife. The inner lamella again is quite different, it is exceedingly delicate, it lines the socket, and is reflected from the bottom of the socket over the central ligament, from which it expands again over the head of the thigh bone, covering that smooth cartilage with which the head of the bone is coated; it descends again along the neck of the thigh bone, and there this fine and delicate covering hangs somewhat looser, and we observe a sort of villi about the neck of the thigh bone, formed by the looseness of this inner membrane. From the root of the neck it again joins the thick capsule, so that this delicate internal lamella is at once the lining of th

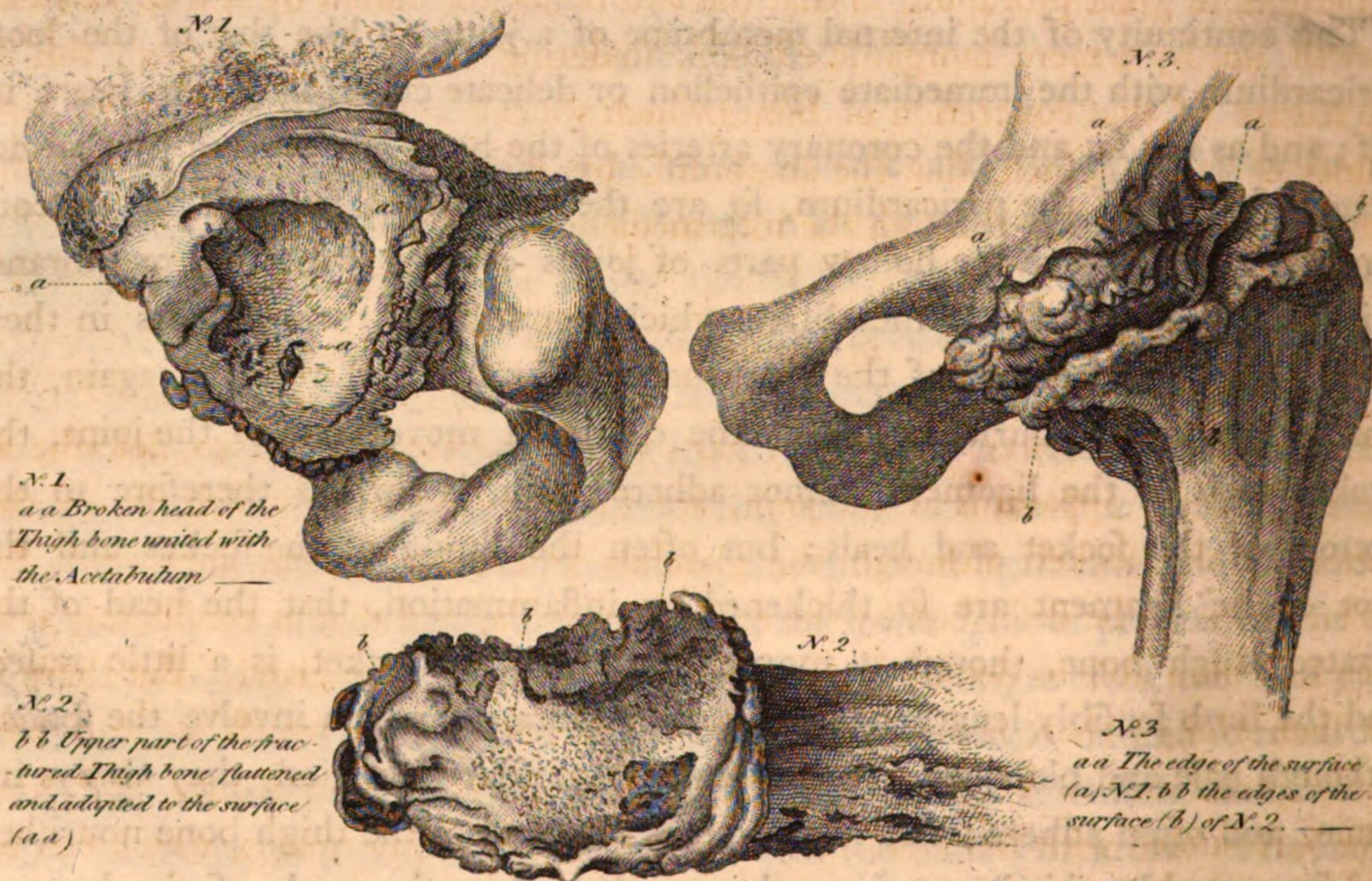
acetabulum, the covering for the head of the thigh bone, the covering also of the round ligament which unites the head of the thigh bone to the centre of the acetabulum, and the general lining of the capsule. This inner membrane is thin, soft, delicate, and at many places (especially where it covers the neck of the thigh bone, and the root of the central ligament), has all the appearance of a villous coat; it is, indeed, the villous coat of the joint, it is the secreting surface; for though we consider the fatty mucous ducts lying in the bottom of the joint as secreting an important part of the synovia, yet there is not the smallest doubt that the greater proportion of that liquor, and all that fluid which we find in dropfical joints, is merely a secretion from the exhalent arteries of this loose, villous, internal lamella of the capsule.

This continuity of the internal membrane of a joint, is like that of the loose pericardium with the immediate epithelion or delicate covering of the heart itself; and as the fat and the coronary arteries of the heart are covered by that delicate inflection of the pericardium, so are the *pellotons* of fat and the mucous fimbriæ which lurk in the hollow parts of joints covered with this membrane, it is the continuity of this membrane which connects all these surfaces in their diseases. When the head of the thigh-bone is luxated and replaced again, the central ligament is burst, but from the continual movements of the joint, the broken ends of the ligament cannot adhere again, it shrinks therefore to the bottom of the socket and heals; but often the lining of the socket and the root of the ligament are so thickened by inflammation, that the head of the luxated thigh bone, though it moves securely in its socket, is a little raised, and the limb sensibly lengthened. These membranes, which involve the bones, although pale and bloodless, are so vascular, that after laceration, they always inflame, and often adhere; and so entirely is the head of the thigh bone nourished and supported by this inverted membrane, that when the neck of the bone is broken away, and the head left in the socket, the head, though apparently insulated, and left hanging by its central ligament, lives, shows strong ossifying powers, and adheres perfectly to the inner surface of the socket; then the socket and the head of the Os Femoris become one inseparable mass of bone; and being thus united together, their ossific power is so strong, that they generate a large mass of callus; and the upper broken end of the thigh bone resting upon this broad mass of ossifying bone (composed partly of the acetabulum, partly of the fractured head

of the thigh bone), gives it by its pressure a shape conformable to its own, and thus makes a broad but imperfect joint *.

This continuity of the nourishing membrane of the bones is the reason of their being connected in disease; and it rarely happens that the head of the thigh bone is affected with caries while the socket remains sound; but wherever this ulcer begins (for it is as truly an ulcer as any open sore in the flesh), the disease extends itself from the head of the bone to the socket, and from the socket over the back of the os innominatum.

* "OS INNOMINATUM ET FEMUR SINISTRI LATERIS, UTRUMQUE POST FRACTURAM COLLI FEMORIS INSOLITO PLANE MODO DEGENERATUM." Sandifort.



Page 528.

This union of the fractured head of the thigh bone, with its inflamed acetabulum, is far from being uncommon. The above plate represents one from the museum of Leyden. The following description from Ludwig, page 373, conveys the idea as fairly as ever a drawing could do. "Femur cum osse innominato dextri lateris ex juvene circiter octodecim annorum nunc coram intuemur, in quo cristæ ilium et condylorum ossis femoris epiphyfes, adhuc separatæ sunt, trochanteres autem major et minor jam prorsus coaluerunt. Epiphysis capitis a collo separata acetabulo accrevit, non tamen integra, sed hinc inde carie adesa, et superficie acetabuli interna aspera reddita; collum femoris, breve, inæquale, ita quidem in parte inferiore elevatum est, ut superficiem, capitulo quodam modo analogam, sistat, cartilagine tamen non incrustatam, sed tantum nonnihil lævigatam."

It is this life of the bone, supported by the nourishing membranes, that approximates the diseases of the bones and joints to the diseases of the soft parts; in ulcer, for example, of the soft parts, while one surface is extenuated by ulceration, the adjacent parts are swelled by inflammation, or protrude in the form of fungous flesh; in like manner, while one surface of a bone is wasted by caries, which is an ulcer of the bone, another is swelled into the form of exostosis, which is a fungus of the bone.

This action and living power in those parts (so hard and apparently so insensible), is the reason why, when the two inflamed surfaces of the bone meet with each other, they unite with continuity of vessels; those continuous vessels support one another in their action, and secrete bone sometimes sparingly, and sometimes in great profusion, so that the two bones are united by a true vascular growth, not by a mere inorganic effusion, folding the bones together; this is the nature of that concretion of bones which we call ankylosis, where the continuity of vessels is such, that the anatomist, by injecting the vessels of the one bone, injects the other through the intermediate callus *.

OF THE FATTY FIMBRIÆ.

Of the FATTY FIMBRIÆ. The only parts which we are entitled to describe as the lubricating apparatus of the joint, are the fatty fimbriæ which lie in the bottom of the socket, although the glandula innominata galeni continued, for Galen's sake, to be described by the early anatomists, and that as confidently as if they had been able to demonstrate a distinct and appropriate gland. But there is no such thing; there is no formal gland; there is nothing which we can certainly pronounce to be glandular. There are indeed certain fringes and fimbriæ surrounded with fat, manifestly secreting a lubricating mucus, which can be squeezed out from them; but this mucus bears no proportion to the quantity that is required for the easy motion of the joint, the synovia sinagma or lubri-

* The drawing in the last page represents one of the most singular accidents; the neck of the thigh bone was broken, the head remained within the socket, the head of the thigh bone and its acetabulum both inflamed, united, and became one piece of bone; and this new bony surface, which was four inches in breadth, was flat and smooth, formed a flat articular surface for the upper part of the thigh bone to rest upon; the upper part of the thigh bone remarkably enlarged and flattened, is also represented. Observe then, that in this case, the head of the thigh bone broken from its shaft, had no source of nourishment but its central ligament and investing membrane.

cating liquor with which the joint is bedewed, is a general secretion from all the surfaces of the joint, in which those fatty fimbriæ which lie at the bottom of the socket, or hang round the neck of the thigh bone, have but a small share; yet these fimbriæ, being undeniably the most delicate part of the joint, deserve particular notice.

The fatty fimbriæ lurk at the bottom of the socket in a sort of hollow, formed by a projection of the ischium at that place in the bottom of the socket where the ischium ilium and pubis are joined; there the central ligament arises from the centre of the socket with a broad triangular root, and the fimbriæ surround the root of the ligament; the hollow or dimple where they lie is covered with the delicate villous lining of the joint. The villous coat is here loose and soft, the hollow in the centre of the acetabulum feels soft and pulpy, and the fimbriæ hang out from it into the cavity of the joint. By this connexion of the fimbriæ with the root of the central ligament, they are moved in every motion of the joint, and by lying in this hollow, these soft and delicate parts are protected and concealed, for the pelvis hangs upon the top of the thigh bone by the upper part of the socket, which is deep and firm, while these parts lying at the bottom of the socket escape the pressure, and feel only, in the most gentle manner, the rotation of the thigh bone; but when the trochanter is struck with a violent blow down into the bottom of the socket, these softer and more sensible parts are hurt, violent pain ensues, and this bruise of the acetabulum, an accident which happens most frequently to old women, is followed by high inflammation of the joint, ending sometimes in caries and ankylosis.

But boys are subject to a disease different in many essential points, for in boys the disease of the acetabulum begins from a slighter blow, or without any blow, and proceeds unaccompanied with pain; it is seated not so much in the soft parts as in the bones, and proceeds from the imperfect union of the three bones composing the socket, their imperfect ossification, their soft and vascular state. This caries of the hip joint in boys is accompanied with little pain, there is much swelling from the vascular and susceptible condition of their bones, the thigh bone is absolutely protruded from its socket, and the limb is remarkably elongated during all the first stage of the disease.

Thus when we consider, even superficially, the peculiar forms of this joint, and the internal constitution of its parts, we begin to understand its various affections; we perceive, why a bruise of the acetabulum should be very severe in the

falls of people heavy, unwieldy, and advanced in years, and why in them the pain and lameness should continue long, succeeded also by a stiffness or absolute ankylosis of the joint, but without any remarkable affection of the bones. We perceive, why in the soft and growing bones of boys the disease should have a deeper seat in the bones themselves, assuming more of the form of a constitutional or scrophulous disease; and if we consider the rambling amusements of boys, their falls in climbing and on the ice, the eagerness and thoughtlessness with which they pursue their amusements, forgetting the hurts they receive, and the Spartan fortitude with which they conceal them, we shall not wonder at this affection of the hip joint being the peculiar disease of boys, nor at its being very rarely observed till it is almost beyond help. From the insensibility of the bones, the joint is ruined before the boy begins to complain, just as a psoas abscess is perceived at the groin, far from the seat of disease (which is in the lumbar vertebræ) before the caries of the vertebræ is even suspected.

From the imperfection of the socket at its lower part, the thigh bone is apt to be luxated downwards; and again, from the great length of the limb acting as a lever, and from the whole weight of the body resting upon this joint alone, it is often luxated upwards, by being twisted out of its socket. From the obliquity and unfavourable direction, together with the actual smallness of the neck of the thigh bone, it is often broken across; and from the blow upon the trochanter striking down the head of the bone into the bottom of the socket, the soft parts are hurt, the whole lining of the socket inflames, and the joint falls into irrecoverable disease.

It is further to be observed, that this joint is covered by big and powerful muscles, so that when the neck of the thigh bone is broken, it is so violently retracted, that the two ends are not regularly opposed to each other, and are never rightly reunited! when the thigh bone is luxated, it is so retained by those strong muscles, that its immediate reduction is not easy, and the distorted head of the thigh bone is so braced down against the large bones of the pelvis! whence it contracts strong adhesions, and its reduction after some interval of time is absolutely impossible: and lastly, when the acetabulum is injured, such is the weight of this massy limb, that the slightest movement of it gives excruciating pain, hence the patient lies for many months exhausted with fever and pain, bent into the posture which he can best endure till ankylosis is formed, and then he rises with a lame and wasted limb, the thigh bone immoveably united with the pelvis,

and the thigh very frequently standing out at right angles from the body. But worse than all, this deepness of the hip joint, surrounded by such thick and massy muscles, prevents us distinguishing easily these various disorders! the dreadful pain which the slightest motion produces, frightens the surgeon from those examinations in which his patient's safety entirely consists, and luxation, which is so easily reduced, often passes for fracture, so that the reduction is neglected or is mistaken for a bruise of the acetabulum or some incurable hurt, till the luxation itself becomes incurable. So much do surgeons despair of doing any essential service in disorders of the hip joint, that if they fail to distinguish the nature of the accident at once, they apprehend that twisting such a limb, and torturing the patient, is but an unmeaning cruelty.

Thus you find yourselves slightly initiated into certain pathological doctrines which must be more fully explained.

GENERAL PATHOLOGY OF THE HIP JOINT.

The soft parts of the living body, when they lose their principle of life, die at once, are dissolved, and perish, but the bones, after death, retain their former properties so perfectly, that in reasoning on their diseases, we almost forget that they ever were alive. Physiologists have been slow in arriving at the right knowledge of the bones, and pathologists have been still slower in applying that knowledge to the state of disease; the inflammation and exostosis or swelling of bones, the caries, ulceration, or erosion, as it has been called, of bones, the various changes produced by disease, have never been explained by the living action of the vessels of the bone. The ignorant man regards the bones merely as bones! and bones, in his estimation, are just what he sees them on the anatomical table or in the cemetery! there they appeared as perfect as while they made part of a living body! if such a bone were broken, the breach could be repaired by any substance capable of concreting firmly round the broken ends of the bone! and he never conceives any more complicated idea of the reunion of a fractured bone in the living body than such a concretion, a pouring out of some ossific juice which concretes round the fractured part.

Is a joint stiffened by ankylosis, then it is the coagulation of the synovia that glues the bones so firmly together that they lose their motion! Is a luxation from length of time become irreducible, it is because in the intermediate space the

exudation of the synovia into the socket has filled it up! is there formed a new socket upon the back of the haunch bone, or has the head of the thigh bone changed its form, have exostoses and prominences of fantastic shapes been produced round these bones, that too is from the coagulation of the synovia, or the concretion of an ossific juice! is the bone carious, that never is regarded as an ulcer of a living bone; the bone is regarded merely as a dead and inanimate part invaded by some dissolving fluid, whence the ulcer is termed an *erosion* of the head of the bone or of the socket, it is said to be *corroded* by some chemical menstruum, just as it has been affirmed time immemorial, that blood dissolves bones. Petit, in a superb dissertation on the causes of anchylosis, attributes every thing to the synovia, to the defect or superabundance of it, to its *acrid* or its *acetous* vices*, and the stiffness, the dryness, the simple anchylosis of the joint, the erosions and caries of the ligaments, cartilages and bones, and all the other consequences of *acrid synovia*, he very fully describes†. This destructive liquor is not described by Justamond as by Petit, under the title of *Synovie Aigre*; it is not exactly vinegar, though it is something as bad, which dissolves the cartilages, and produces caries of the bones; "the *glands tumefy*, and sometimes produce a synovia, which, partaking of the distempered nature of the organs that supply it, is not entirely absorbed; or else this liquor degenerating BECOMES ACRIMONIOUS, DESTROYS THE CARTILAGE lining the surface of the joint, and the head of the bone; the articular and capsular ligaments *are eroded with caries*, and in process of time," &c. But in truth, such acrid, acid, eroding secretions, have no more to do with the destruction of the bones and cartilages, than the thin ichor of a chancre has with the sore from which it proceeds, which nei-

* "Dans tout ce que nous avons dit jusqu'ici des causes de l'anchylose, on a pu remarquer que la synovie a beaucoup de part à la formation de cette maladie, et qu'il n'en est presque d'aucune espèce où la synovie ne soit pour quelque chose; mais nous allons traiter ici expressément des vices de cette humeur, savoir, sa quantité excédente ou défailante, et sa qualité âcre, aigre, ou fereuse; vices qui sont les sources d'un grand nombre," &c.

† "Si l'âcreté augmente, le désordre augmentera aussi. Les cartilages ne feront pas seulement privés de la liqueur onctueuse qui les lubrifie, leur surface lisse et polie, corrodée par l'âcre, deviendra inégale et raboteuse; les ligamens, insensibles au mouvemens des os et aux attouchemens de la synovie naturelle, seront dans le repos même, susceptibles de douleur. L'action de l'âcre les irritera et leur causera un phlogose d'autant plus douloureux, qu'ils sont attachés à des corps durs et inflexibles, qui ne peuvent en prêtant partager avec eux leur tension inflammatoire. Ainsi toute l'articulation s'enflamme, l'âcre fermente avec les suc nourriciers, et bientôt les os se carient et les ligamens suppurants, il se forme une anchylose des plus formidables."

ther produces the sore, nor can produce a similar ulcer in the adjacent parts. The *soldering together* of bones, and especially the *soldering together* of the acetabulum and thigh bone, are expressions continually repeated by Justamond, Gouch, Pott, Bromfield, Warner, Petit, and all those authors who have written on the bones or on fractures; but if there be meaning in figurative language, such expressions imply either very imperfect notions, or doctrines totally opposite to truth.

This doctrine of acrimonious synovia and exudation of offic juices has no manner of analogy with the parts even the most inanimate of a living body, if it be indeed rational to suppose the bones less perfectly alive than the soft parts, when in truth the whole joint, and all the parts which compose it, insensible as they seem, are yet endowed with living powers.

The bones, cartilages and ligaments, though slow to enter into disease, though their diseases are not at first announced by pain and immediate swelling, yet undergo the same changes with the soft parts. A fractured bone inflames, granulates, and unites again! who, indeed, can doubt this, who has ever observed a carious bone exfoliating, or has remarked the granulation and healing of a trepanned skull? When a bone or a joint is injured, the ligaments and surrounding soft parts mass and thicken by inflammation, cling to the bones and support them; when a bone is fractured, it unites with the opposite broken end of the same bone; when a bone is not opposed, or not steadily opposed to another fractured bone, the continuity of vessels cannot be renewed, but still the vessels are excited, they secrete bone, and form new bone or callus within the substance of the surrounding soft parts, so that the broken ends of the bones, thus thickened and expanded, form new surfaces wanting indeed the properties of joints, but yet allowing of a degree of motion without pain. When a bone is luxated, and remains so, there also there is much laceration of the ligaments and soft parts, much inflammation, a high excitement of vessels, a secretion of bone, and often something representing the original socket is formed upon the convex surface of a great bone, as of the scapula or haunch bone. The surrounding ligaments always thicken in proportion to the violence done to the joint; the cellular substance also is inflamed and thickened, the ligaments, insensible as they appear, not only inflame, but granulate and adhere with the fractured or luxated bone †, and unite and mass along with the surrounding soft parts. There is

† Even Petit, whose pathology of the bones is in all respects despicable, seems to have witnessed, very

another very singular consequence of this inflammatory action among the injured parts, and it is this, the surrounding cellular substance, ligaments, &c. are inclined to adhere at that part of the bone where there is little motion, and where the bone or the soft parts formerly connected with it are lacerated, while the same cellular substance and lacerated ligaments continue disconnected with the head of the bone, which is lubricous and smooth. Thus, a bone, whether fractured or luxated, contracts new adhesions, new connexions, and forms for itself among the cellular substance, new capsules and ligaments of such thickness and strength too as not merely to bear the motions of the new joint, but such as to suffer the whole weight of the body to rest or hang upon them.

What does the surgeon understand concerning this most interesting department of his profession, unless he is able to make rational conjectures concerning those changes, to distinguish the various affections of a joint, to observe and watch the progress of the disease, and to conduct it prudently; to appease the inflammation if possible, but to favour, on the contrary, the generation of bone, and the establishment of ankylosis where no better cure can be expected. Those doctrines which disgrace the writings of Petit, Justamond, and the best modern surgeons, have done infinite harm in practice. Have not surgeons, when the Olecranon was fractured, kept the fore-arm bent in a posture the most painful and the most ruinous to the structure of the joint, in order to make room by the distance of the bones for any excess of callus? fearing lest the callus being in great profusion should run into the cavity of the joint. Have they not for the same reason bent the knee in fractures of the patella? Have not the most celebrated surgeons moved diseased joints morning and evening with most deliberate cruelty, in order to do we hardly know what! to waste the superfluous synovia †, to prevent its accumulation, to

often, the very beginnings of this interesting process, and to have seen this granulation of the ligaments, and this fleshy condition of fractured bones, when they were so soft, as to bleed when rudely touched.

“ J’ai trouvé, dans l’ouverture d’un semblable abcès, que les os étoient *carnifiés*; je veux dire que la tête du fémur et la cavité de l’ischion, éloignées l’une de l’autre par la luxation, mais toutes deux découvertes par l’ouverture de l’abcès, avoient la même consistance et la même couleur que la chair. Le volume de ces os étoit considérablement augmenté, et *ils étoient si semblables à la chair qu’ils saignoient au moindre attouchement*. Cette observation n’est pas la seule que j’aie de cette espèce, j’en rapporterai, dans la suite, plusieurs qui ne sont pas moins surprenantes; et qui prouvent que si les chairs s’ossifient, les os peuvent aussi devenir semblables aux chairs.”

† La synovie s’épanchant continuellement dans l’article, s’y épanchant même alors plus que dans l’état naturel, et n’étant plus *dissipée par les mouvements* de la partie, on ne doit point être surpris qu’elle s’accumule, et qu’elle remplisse la cavité au point de chasser la tête de l’os, &c.

force it to re-enter into its ducts †; have they not tortured and bent joints in the very act of forming ankylosis, or in other words, when the opposite vessels of the bones have been uniting with each other? Have they not given pedantic directions for the period at which such motions should be begun §? Mr. Freke's chemico-mechanical illustration of the acrimony of the synovial liquor will not, I believe, be soon forgotten, who compares the synovia with "olive oil for locks, but if in place of it oil of vitriol be used, says Mr. Freke, the effect need not be told."

PATHOLOGY OF LUXATION.

It has been, perhaps, too little observed, that the causes of luxation and of fracture, are as different as the causes of hydrocele and aneurism; fracture always, or almost always, arising from a fall, a blow, or a violent strain of the muscles; while luxation as certainly arises from a twist of the joint, and happens only when the weight of the body, in some awkward posture, comes to bear entirely upon the joint, the limb being so far out of its natural direction, as to be entirely beyond the power of its own muscles.

The two great joints of the shoulder and hip are peculiarly liable to luxation, first, Because they are ball and socket joints moving in all directions with a free and circular motion; secondly, Because of the length of the limb to which they belong! for the joint is at the trunk of the body, and in any unlucky posture and twist of the limb, the whole weight of the body rests upon the joint, and the limb serves as a long lever by which the head of the bone is twisted out of its place. But as for the elbow and wrist, knee and ankle, they have but one motion, they are merely hinge joints, they are secured by bones, or by ligaments equivalent in strength to bones, they are rather fractured than luxated.

It is when the body slides or falls that the shoulder or hip are luxated, for then the whole weight of the body falls on the joint and bursts it up. If a man be struck, for example, upon the top of the shoulder, or if being thrown from his horse he pitches upon the shoulder, such accident may break the acromion which projects and defends the joint, or may fracture the clavicle which is the hinge as it

† Ou remuë souvent la jointure pour obliger la synovie a rentrer dans ses *coulours*.

§ Le temps et la façon de mouvoir les jointures *disposé* a l'*ankylose* ne sont pas une chose indifferente, ou a deja dit qu'il ne faut commencer de les remuer que quand la violence des douleurs est passée, il est tres dangereux, &c. one might venture to prognosticate, that being a joint, moved soon after the pains of a disease, about to terminate in ankylosis, those pains would not be long of returning.

were upon which the arm rolls (the only point indeed by which it is connected with the trunk of the body), but cannot luxate the joint. The shoulder is usually luxated, when having slipped a foot we put out the arm to save us from the fall; the arm is at its full stretch, is raised and extended as high as the joint will allow; the joint can allow of no further extension without bursting, and the limb is beyond the command of its muscles: in this critical posture is the arm when the whole weight of the body falls upon it; the length of the arm is as a lever for twisting the humerus out of its socket, the joint is burst up in an instant with a crash and laceration of its ligaments, which is very sensibly felt by the man himself, and the head of the bone is thrust down into the axilla, or is pushed perhaps under the pectoral muscle.

In like manner is the hip joint luxated by a twist, and not by a blow; a blow separates the head, or breaks the neck of the thigh bone, or bruises the acetabulum, but seldom if ever luxates a joint. For example, when a man slips his foot, the limb glides in under the body, the knee is straight, the outer ankle slides along the ground; the leg in this oblique posture bears the whole weight of the body, the chief stress is upon the hip joint, the thigh bone starts up from its place, overleaps the cartilaginous border of the socket, and lodges on the back of the haunch bone or in the sciatic notch: Thus is the thigh bone luxated upwards.

But if a man, for example, in driving a loaded cart, observes it heeling in a bad road, and likely to overturn; if he strides out with one leg, plants it close to the wheel, and tries with his haunch to support the carriage; if in this posture, and with the leg extended, he is unable to support the carriage and it falls upon his haunch, then the extended leg is as a long lever upon which the weight operates; it bursts up the joint, forcing the head of the bone from its socket down into the sciatic hole or into the groin. The effect is quite the same, when a man in loading, for example, a sack of corn upon a cart, lays it upon the cart, and expects another person in the cart to support it, who, on the contrary, allows it to fall back upon him just when he is retreating, has moved one leg, and has the load half supported with the other leg and hip. The effect is the same, when a man loaded with a burden on his back slips his foot and falls, so that the inside of one knee strikes the ground and sustains the whole weight of the body, the other having slipped from under him; and still it is from a twist that the thigh bone is pushed downwards, when a horse rears, falls backwards upon his rider and luxates the haunch, or when a man buried into a mine or pit, or crushed under the weight of earth falling in upon him, has his hip luxated.

In what degree the ligaments of the joint will extend when they are gradually dilated by a collection of serum within, we need not at present dispute. Unquestionably they are capable of distension, of almost incredible distension; but that the head of the thigh bone should be all at once displaced by a twist, forced clear out of its socket over the back of the haunch bone, and lodged in an instant at the distance of four inches from its natural place, without laceration of its ligaments, with its ligaments merely dilated, is impossible. There is, indeed, no fact of which we are better assured than this, that when the head of the bone is twisted out of its socket, there is no dilatation of the capsule, there is no subluxation, as it is called! the head of the bone never stands upon the edge of the socket, for then it would immediately fall back into its place; but the capsular ligament is burst, the central ligament is torn up from its root, the muscles which lie in the thyroid hole, or on the back of the haunch bone, are displaced, to make way for the head of the thigh bone, which lies betwixt the naked haunch bone and those lacerated muscles, and there it remains, undergoing changes which are of the most interesting nature.

OF LUXATION OF THE FEMUR DOWNWARDS.

1st, While the head of the bone lies thus among the lacerated parts, the slightest motion occasions excruciating pain, and as the slightest motion prevents adhesion, the head of the bone continues long reducible. When the bone is first driven out of its socket, the patient hears the crash of the lacerating ligaments, and when a recent luxation is reduced, the head of the bone being distorted in respect of its posture, and very firmly braced down by the contorted muscles, goes home into its place with a violence proportioned to the tension of the muscles with a loud snap; but when an old luxation is reduced, the reduction, which is opposed by the strong adhesions, requires a force equal to that by which the bone was luxated, if not greater; and in the instant in which the adhesions give way to that force, the patient and the surgeon both feel the same crash of laceration which accompanied the first displacement of the bone; it often sounds as if the neck of the bone were broken by the violence. This is the sign of the luxation being reduced, and the surgeon should be aware of it; for I have often been sensible of this crashing and laceration among the ligaments, which announces the yielding of the dislocated bone; but as the head of the bone does not, in such old luxations, go home with a sudden nor distinct snap, the extension has, to my certain knowledge, been often continued, even after the bone has been reduced, and that

with a degree of violence almost sufficient to tear the limb from the body. Observe this in your future practice, and you will find that I am not incorrect; and if what I have alleged be true, the vis percussiois (far from being a subject for thoughtless jokes) is perhaps absolutely necessary to the reduction of old and confirmed luxations.

2d, Though the capsule so entirely surrounds the joint, that it can in no case escape sudden laceration when the head is driven from its socket, yet the muscles, which are small, which turn round the joint with small tendons, and are implanted about the roots of the trochanters, and are but slightly connected with the capsule are very seldom torn. The head of the bone bursts sheer through the capsule, and tears it in a very irregular way; but it passes out betwixt the tendons of the muscles, without tearing them; therefore it happens, that as soon as the bone is reduced, as soon as the head of the thigh bone is drawn out from among the lacerated parts on the back of the haunch bone, and again lodged in its proper socket, all pain ceases, the patient exclaims that he is relieved; and as the muscles preserve their attachments to the bone, and are now restored to their offices, he moves the joint as easily, and walks upon it as firmly as before, and returns to his business or pleasures sometimes without one day's interruption; and though the capsule is completely lacerated, yet as it is connected on its external surface with the surrounding parts, and these also are injured, they swell, and the surrounding parts being close, the edges of the lacerated capsule are regularly opposed to each other, and the entireness of the capsule is soon and easily restored; rest is not necessary to these adhesions.

3d, When the head of the bone *remains unreduced*, new and important changes take place on the head of the bone itself, and on the part against which it rests. When the thigh bone is luxated downwards, it displaces in some degree the obturator muscle, and rests in the hollow of the thyroid hole covered by the lacerated muscle, and pressing against the bone, and there it lies braced down by the distortion of the other muscles. The surgeon cannot turn it in examining the parts, except in a very slight degree, so firmly is it embraced by the muscles; and besides, the patient is careful to prevent even the slightest motion, for motion is productive of excruciating pain. He lies immovable for some weeks! the hollow in which the head of the thigh-bone lies, is lacerated and raw; the parts surrounding the neck of the thigh bone are also lacerated, which parts mutually adhere so as to form a new and perfect capsule. The head of the bone resting in the thyroid hole, as in a socket, comes at last to move in it with a degree of ease; and

the pelvis, resting thus fairly upon the head of the thigh bone, is steadily supported; and though the leg is much lengthened in this luxation, so as to make the patient halt towards the sound side, yet the limb thus luxated downwards bears up the body firmly.

This is one striking peculiarity of the luxation downwards into the thyroid hole. But still farther changes take place, very slowly indeed, for the changes I mean now to speak of affect the bones themselves. It seems to be after the thigh bone is fixed in its new situation, and after the continuity of vessels is restored, that the bones begin to change their form. The soft parts connected with this surface of the pelvis are all swelled, vascular, inflamed, and in the condition of the periosteum and soft parts surrounding a fractured bone. This mass of active vessels connected directly with the vessels of the bone itself, draws them also into an active state. A secretion of bony matter begins, the new bone is deposited in the now inflamed capsule in the surrounding cellular substance, and among the lamellæ of the obturator ligament, against which the head of the bone rests, and which is of course irritated and inflamed. The thyroid hole comes in time to be filled up with ossification, so as to make a bottom for the new socket. The edges of the thyroid hole sprout out so as to form lips or edges for the socket; and these edges sometimes are so deep as to surround entirely the neck of the thigh bone, and to form a complete box of bone*, in which the head of the thigh bone is so enclosed, that though perfectly moveable, the head cannot be disengaged from its new socket.

Nor does even the thigh bone itself always retain its original shape; while excitement enlarges a bone, pressure, on the contrary, prevents its growing in a young person, or even lessens it when full grown. The thigh bone, when thus luxated, bears the weight of the body in a new direction, the obliquity of the neck is lost, the head of the bone now receives the pressure in one direction only, whence the head of the bone is flattened, and the neck is in time depressed, loses

* Mr. Morreau, describing such a natural cure, remarking this profusion of new bone, and not understanding perfectly the process of ossification, considering always callus as something very different from natural bone, and never reflecting on this, that every piece of bone, when injured, when its vessels are opened, and the parts torn all around it! is apt to produce more bone, makes the following unphilosophical remark: "Nothing can be DROLLER than the unequal distribution of the osseous matter which spreads to the contiguous parts, for there are BONY VEGETATIONS at the upper part of the great trochanter which are of no USE in the CONSTRUCTION of this BOX (Boete Osseux). In short, the gentlemen of the French Academy talk on such occasions as if Nature designed specifically and absolutely to make a box of a particular shape and size, and then having set Nature her task, and finding the box not exactly fashioned according

all its obliquity, is shortened, and stands out at right angles from the shaft of the bone; and as the shoulders and neck of the bone now press against the lower part of the empty socket, that part yields to the pressure, the lower edge of the socket is depressed inwards, and the general cavity of the socket, now forsaken by the head of the bone, is almost filled up.

LUXATION OF THE THIGH BONE UPWARDS.

4. When the thigh bone is luxated upwards and remains unreduced, the new joint and all its apparatus is less perfect, and the patient continues very lame. The

to their imagination, and seeing irregularities which they did not expect (and which they have no theory, except, indeed, the old Stalactytical Theory), to account for, they think Nature's work "very absurd and droll."



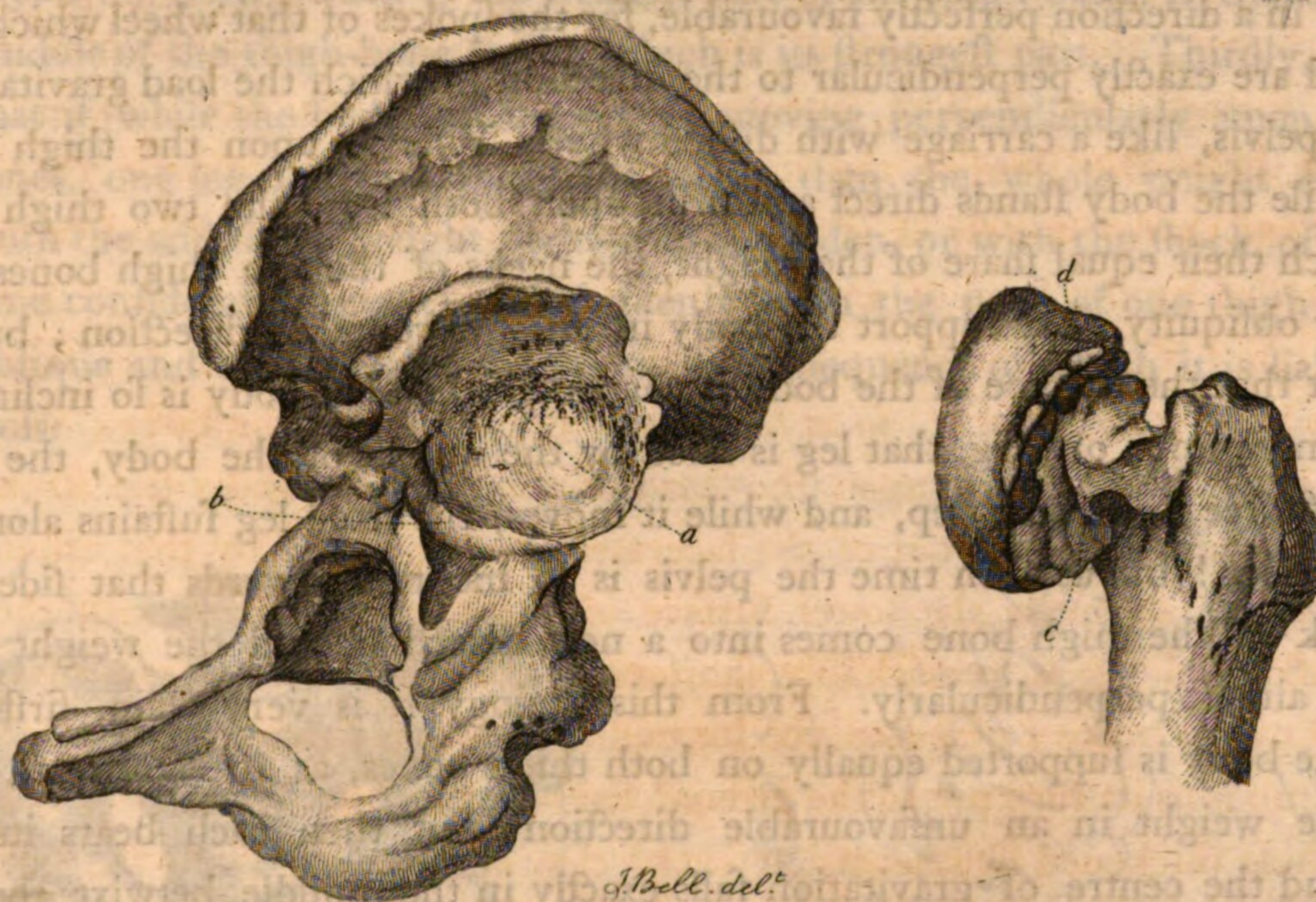
Page 341.

I have given in this drawing one of the most extraordinary facts in this department of pathology. I have represented here a thigh bone which was luxated downwards and backwards into the sciatic notch, and there formed for itself a new socket, where, though entirely enclosed in the box, as the French academicians have chosen to call it, it was still entirely moveable. "Coxa est sinistra cum ossē femoris, cujus caput intra profundissimum acetabulum sic retinetur, ut, licet certo sensu mobile et nullibi cum acetabulo concretum sit, tamen ex eo tolli nequeat." Even Sandifort, a pathologist much superior to Morreau and his confreres, is much at a loss to explain this phenomenon. In one place he says, "Tota capsula articularis videtur hoc in parte in os abiisse." One thing is very curious, that in this new socket there is a certain opening separated from the rest by a thin partition of bone, through which the vessels enter which supply the joint.

head of the thigh bone is now lodged on the back of the haunch bone, upon a flat and gliding surface, the head of the thigh bone obtains a fixed place very difficultly; there is no hollow like the thyroid hole to receive it; the convex head of the thigh bone is applied to the flat surface of the haunch bone, so as to touch it almost by a mathematical point; there is not here, as in the luxation downwards, a variety of surface and great extent of bone wrought upon by the head of the femur; the generation of bone is very sparing; an accidental socket is indeed formed, but shallow, smooth, irregular, not deep, not sufficient to receive or lodge the head of the thigh bone; it is rather a dimple than a solid socket, and looks merely as if the haunch bone being softened had been slightly impressed by the head of the thigh bone. How does the patient walk then in this case? Very miserably; his thigh bone rather lies upon the side of the haunch bone than under it, so as to support the weight of the body; the weight of the body is suspended upon the head of the thigh bone by the strong ligaments that are generated out of the lacerated capsule, aided by that cellular substance which connects the lower surface of the glutæi muscles with the bone. The dislocated leg is remarkably shortened, and when the patient rises on the sound limb to make a new step, the luxated bone hangs in air; and when the dislocated limb is in its turn put to the ground, the whole weight of the body falls heavy upon those thickened ligaments; at every step the patient twists the body, and turns the pelvis so as to throw the haunch bone flat upon the head of the thigh bone, and this inclination of the trunk, together with the shortness of the limb, distorts the whole body; and in this case the weight falls so heavy upon the neck of the thigh bone, that it gives way under it. The head of the thigh bone is flattened, the neck is shortened, it is also bent downwards, as if it had given way, as if it had slid a little lower along the shaft of the bone. When we look at the thigh bone which has been long luxated, we should at first believe that it had been actually fractured, and the neck shortened; but upon examining the neck, we find no mark of fracture, while we easily distinguish many marks of the long continued pressure, for the whole of the upper part of the thigh bone, even to the trochanters, is extenuated, the neck is somewhat extenuated and bent down, the head also is smaller than that of the sound thigh bone, and on the top of the globular head of the thigh bone is a depression or flatness, indicating the place where the back of the haunch bone rested upon it.

In such a luxation remaining unreduced, the weight of the trunk is ill supported, the motions of the joint very imperfect, the limb remarkably shortened,

and wasted in some degree, while the whole person is distorted and bent towards the lame side. Though such luxation happened during infancy, the person never recovers, but continues lame, pained, unable to ride on horseback, easily fatigued, equally unfit for business or pleasure, and reminded of his misfortune every moment of his life*.



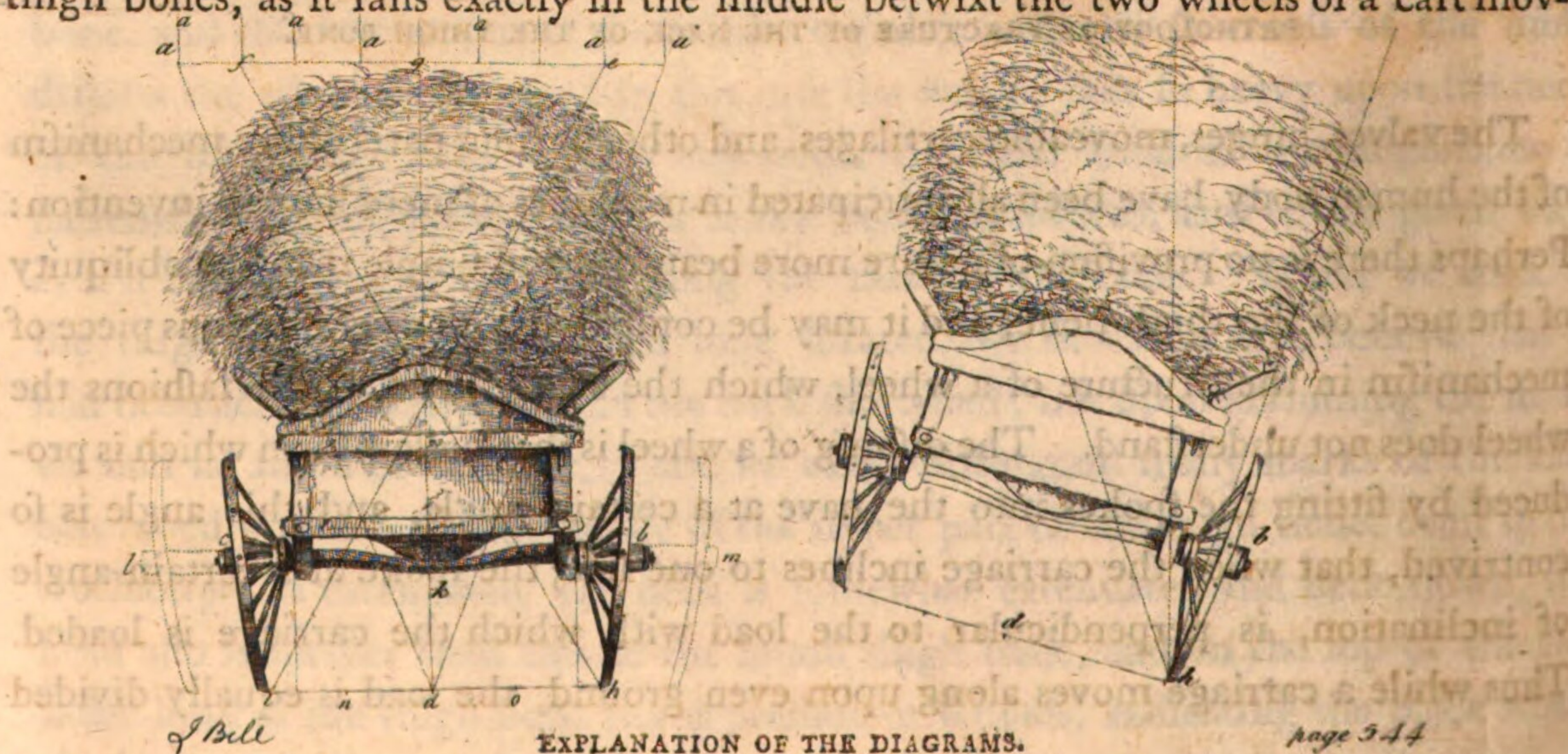
PATHOLOGY OF FRACTURE OF THE NECK OF THE THIGH BONE.

The valves, hinges, moveable cartilages, and other curious parts of the mechanism of the human body, have been all anticipated in machines of mere human invention: Perhaps there is no provision of nature more beautiful and simple than the obliquity of the neck of the thigh bone, and it may be compared with a very curious piece of mechanism in the structure of a wheel, which the coarse hand which fashions the wheel does not understand. The dishing of a wheel is that hollow form which is produced by fitting the spokes into the nave at a certain angle, and this angle is so contrived, that when the carriage inclines to one side, the spoke at a certain angle of inclination, is perpendicular to the load with which the carriage is loaded. Thus while a carriage moves along upon even ground, the load is equally divided.

* This is a drawing of a thigh bone long luxated, where (a) shows the new socket very superficial. (b) The old socket almost obliterated by the pressure of the head of the thigh bone on its upper border. (c) The neck of the thigh bone depressed almost to right angles with the shaft. And (d) the head of the thigh bone flattened above by the pressure of the haunch bone against it.

between the two wheels, the spokes lie out from the carriage at an angle, the load falls upon the spokes of each wheel in an unfavourable direction, but then both wheels bear an equal share of the load. On the contrary, when the carriage moves on uneven ground, and is inclined, it moves upon one wheel only, while the other just touches the ground; then one wheel alone supports the whole load, but it supports it in a direction perfectly favourable, for the spokes of that wheel which bears the load are exactly perpendicular to the direction in which the load gravitates.

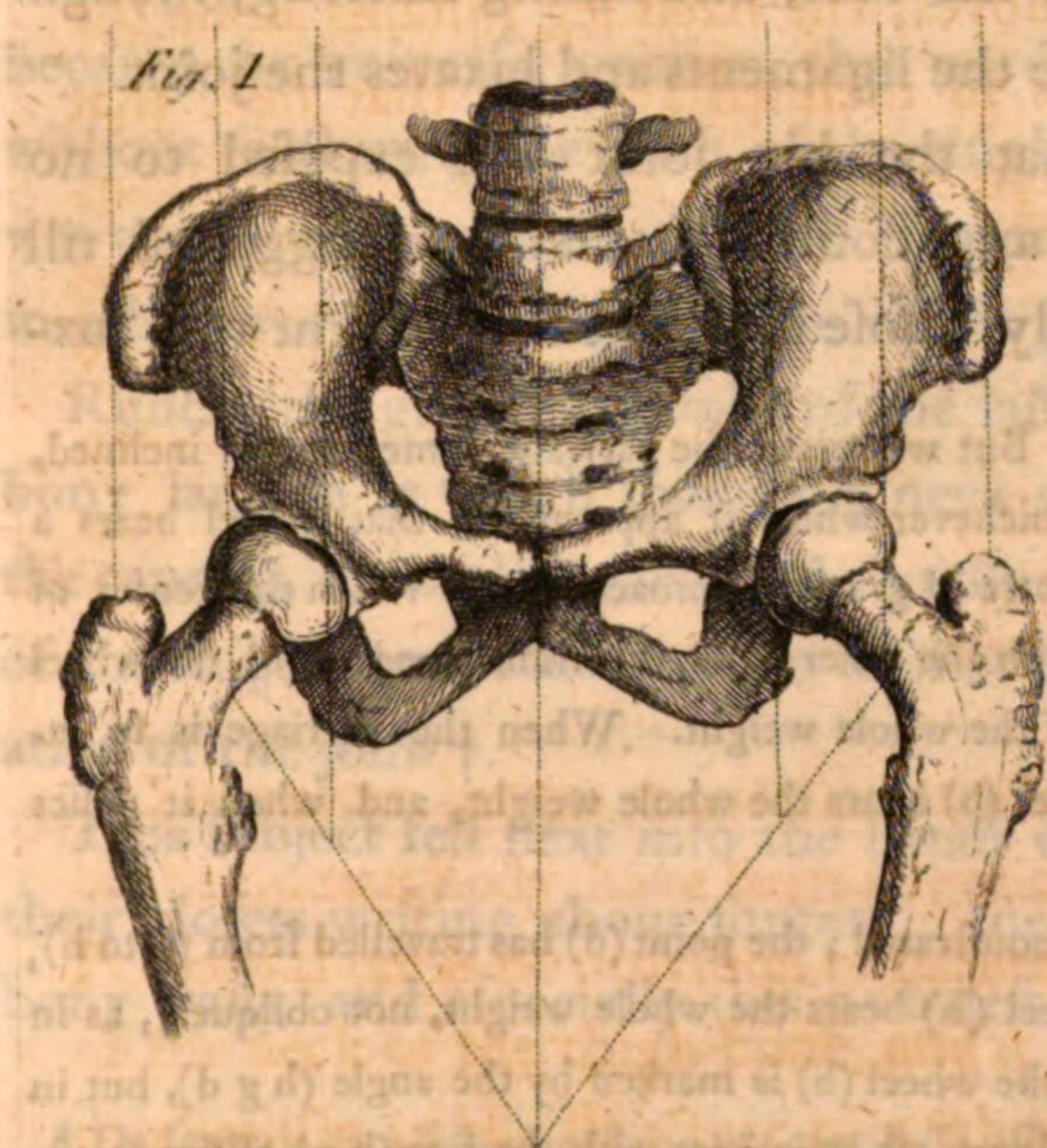
The pelvis, like a carriage with dished wheels, rests so upon the thigh bones, that while the body stands direct and firm upon both legs, the two thigh bones bear each their equal share of the weight, the necks of the two thigh bones have all their obliquity, they support the body in an unfavourable direction; but the moment that the balance of the body is changed, when the body is so inclined as to rest more upon one leg, that leg is fixed by the weight of the body, the other leg is left free to make a step, and while it moves, the fixed leg sustains alone the whole weight! but at such time the pelvis is so inclined towards that side, that the neck of the thigh bone comes into a new direction, and the weight bears upon it almost perpendicularly. From this analogy it is very plain, first, that when the body is supported equally on both thigh bones, as in figure 1st, they bear the weight in an unfavourable direction; but then each bears its own share, and the centre of gravitation falls exactly in the middle betwixt the two thigh bones, as it falls exactly in the middle betwixt the two wheels of a cart mov-



EXPLANATION OF THE DIAGRAMS.

In these two plans (a a a) signifies the perpendicular direction in which all bodies gravitate, and the angle (d e f) represents the whole load, while (d g) represents the centre of gravity of the whole. Were a wheel put in at (k) the whole load would be balanced upon that single wheel, but by two wheels the basis which

ing on level ground. But, fecondly, That when the body is defignedly inclined to one fide, the whole weight falls upon the neck of one thigh-bone, but then it falls upon it in the moft favourable direction; the gravitation is not perpendicular, it is tranfverfe with regard to the direction of the neck, it is in the direction of the neck itfelf, which is oblique, as at (a figure 2.); and thus the weight, inftead of falling upon the neck, which is the weakeft part of the thigh bone, is transferred to the middle of the thigh-bone at (b), which is its ftrongeft part. Thirdly, It appears, that if, while the body is ftanding or moving perpendicularly upon both thigh bones, one leg flip from under the body, then the whole weight of the body (with the additional weight perhaps of a burden, or with the fhock of a fall from fome confiderable height), falls fuddenly upon the neck of one thigh bone, in an oblique and unfavourable direction, in confequence of which it is liable to fnap acrofs.



bears the load is broadened, the carriage ftands firmer, and broadening the bafis ftill more by prolonging the axle, and removing the wheels to (l m) ftill further from the centre, the carriage would be ftill more fteady. The whole load then is divided equally betwixt the wheels (b and c), and the angle (c g d) fhows what proportion of the weight belongs to the wheel (c), while (i g) fhows the oblique direction in which the fpoakes of the wheel (c) bears its load, the angle (h g d) fhows the fhare of the weight which the wheel (b) bears, while (h g) fhows the direction in which the wheel (b) bears its load. The refult of this demonstration is, that the load is born by the wheels (b and c) equally, becaufe the centre of the whole load (d) is alfo in the centre of

Thus our body is every where perfect and imperfect; wherever there are particular provisions of nature, we are sure there is some weakness or defect. This obliquity of the neck of the thigh bone is at once the cause of its weakness and of its strength. First, It is necessary that the joint should move in large and free circles; and for this purpose the head is set off from the shaft of the bone by a considerable length of neck. The position of this neck, which is almost transverse in many circumstances to the gravitation of the body, is the cause of its frequent fracture. When a man dropping himself from a window, expects to light equably upon both legs, and the whole force falls upon one*; when a man going down a staircase which has no rail, walks over the side of the staircase in the same posture as if he were making a fair step; when a man walking along on even ground falls into a pit, for example, into the unguarded foundation of a house, he is liable to break the neck of the thigh bone, which is also sometimes broken by a blow upon the trochanter, and sometimes by slipping the foot, and falling sidelong, though such an accident more commonly bursts up the ligaments and luxates the joint.

For ages physicians had imagined, that the hip joint was exposed to no other accident except luxation, nor was any doubt of this ever suggested till the time of Paræus. He was called to a lady whose hip joint he thought was lux-

the carriage, and in the middle betwixt the two wheels. But whenever the carriage comes to be inclined, the point (d) begins to travel along the line (h i), and whichever wheel it approaches, that wheel bears a part of the whole weight, greater in proportion as the centre of gravity approaches it. When the center of gravity removes to (n), the wheel (c) bears more; when, on the other hand, it is transferred to (o), the wheel (b) bears more than its due proportion, perhaps 3-4ths of the whole weight. When the carriage is so inclined that the point of gravitation arrives at (h), the wheel (b) bears the whole weight, and when it passes (h), the carriage overturns.

In the second diagram, this degree of inclination is demonstrated; the point (d) has travelled from (d to h), the carriage is at the greatest point of inclination, the wheel (b) bears the whole weight, not obliquely, as in the first figure, where the proportion of weight born by the wheel (b) is marked by the angle (h g d), but in figure 2d, the line of gravitation, which is marked (d g) figure 1st, coincides with the line (h g) of figure 1st, which is the direction of the spokes of the wheel (b); for the line (g d), which is the line of gravitation, moves by the inclination of the carriage towards the line (g h).

* “Voici ce que j’ai vu. Un homme voulant descendre d’une fenestre un peu haute, se glissa le long du mur, le dos tourné du côté de la rue, et se tenant sur le bord de la fenestre avec les mains, lorsqu’il se fut allongé pour approcher, autant qu’il le pouvoit du pavé, et tomber de moins haut, il lâcha ses deux mains, et tomba à terre sur la plante des deux pieds, mais inégalement. Le pied droit porta le premier, et souffrit tout le poids du corps, dont la force étoit multipliée par la vitesse de la chute. Le pied, la jambe et le corps du fémur résisterent, parce que la ligne de direction du poids du corps tomboit perpendiculairement dessus; mais le col du fémur, par la raison contraire, se cassa à cause de son obliquité.”

ated; he imagined also that he had reduced the bone by extension, and accordingly he secured it with a slight bandage, but the next day, when this bandage was undone, he found to his great surprise the limb shortened again, and then only did he become sensible that the thigh bone was broken at its neck.

This single observation was not unimportant, nor was it overlooked by his contemporaries. The same passion for novelty which makes every new quackery acceptable in the present day, made every new observation, especially concerning dangerous luxations and fractures, acceptable to the diligent honest people who professed in those days neither philosophy nor the talent of making discoveries! who affected nothing but plain surgery. There were not many anatomists; their observations were few, but they were respected, they were, indeed, received with such universal enthusiasm, that often, as in the present instance, their new observations degenerated into new prejudices. It had been the opinion for many ages that the hip joint could only be luxated; but in the beginning of the present century it became the universal opinion, that no degree of force could luxate the hip joint without fracturing the neck of the thigh bone; if they acknowledged luxation, it was only that species of it which they termed luxation from an internal cause, or, in other words, the suppuration of the joint! the hip disease*.

Ruisch, the great anatomist of the last age, was the first to remark how thin the bony lamella is which forms the neck of the thigh bone, and how wide and large the cancelli are in that part. He boldly concluded, from this weakness of the neck of the thigh bone, that fracture of that part was infinitely more frequent than luxation of the joint†.

This subject fell next into the hands of the speculative physicians, who sat in their closets writing about surgery; they also noticed this singular thinness of the bony walls, and especially this wideness and openness of the cancelli in the neck

* *Os femoris raro sola vi externa, ex acetabulo ossium innominatorum, ex articulari propter vastos musculos et ligamenta articulum munientia! ab AFFLUXU autem HUMORUM id pluries contingere unicuique fatis notum. RUISCH, page 30.*

Fracturam autem facile patitur in ejus collo propter ejus teneritatem, collum enim maxime parte constat ex osseo-spongiosa substantia instar deploes cranii quæ substantia obducta quidem lamella ossea dura verum tamen illa est admodum tenuis hinc facilius frangitur quam aut articulus suo loco excidat.

† *Cependant s'ils eussent fait attention au peu d'épaisseur de la lame de substance compacte qui revêt le tissu cellulaire et spongieux, dont le col du femur est formé ils auroient aisément compris que si les violences extérieures sont capables de déplacer la tête de cet os elles peuvent en un grand nombre de circonstances occasionner le fracture de son col. SABATIER, page 630.*

of the thigh bone, and assigned the true cause for this peculiar structure. "The neck of the thigh bone has an osseous lamella externally no thicker than the nail, and within it is nothing but mere cellular substance: How, without this peculiarity of structure, could the marrow rise along the tube of the bone, or exude as it should do into the cavity of the joint? How could this exudation take place without this open texture of the cancelli? This is the reason why slender people feel always a sort of pain and weariness after walking far †."

When once their imagination had gone abroad in search of theories to explain what they had resolved to believe, they proceeded next to examine the ligaments, and having proved the bones weak enough to account for the frequency of fracture, they made little doubt of being able to prove, by the strength of the ligaments, that they were too powerful to admit of luxation. "This ligament (says Boerhaave), this central ligament of the thigh bone, is of such remarkable strength, that though you should take a corpse, hang it by the heels, and hang a weight of a thousand pounds round the neck, it will never give way." The observation of Fernelius is still more decisive: "When Count Sebastian was executed at Leyden, four wild horses could hardly tear the limbs § afunder."

Yet let us do no injustice to the memory of Ruifch. He was persuaded that fracture of the cervix femoris was the more frequent accident, not merely by this observation of the thinness of its bony lamella; he seems to have enquired into the fact with commendable diligence. "I am informed (says Ruifch) by D. Borst, who, in the course of his surgical practice, has many opportunities of opening the dead bodies of cripple old women, that of eight bodies which he had dissected, he had found not one of them luxated, but in every individual of them there was a fracture of the neck of the thigh bone ||."

† Sed cervix femoris tenuissimam habet lamellam vere osseam, vix unguis crassitie reliquum est mera substantia cellulosa. Hoc ideo factum est quia maximam partem medullæ femore contenta huc deferri oportet in mediam articuli cavitatem; id vero non potuisse contingere nisi ea parte os cellulosum factum medullam fineret transfundere." This is good, but what follows is inimitable. Inde! inde fit! ut macilenti homines inter obambulandum quando nimis longa itinera tentant, doloris quemdam sensum hic percipiant!!! BOERHAAVE.

§ Hoc uno ligamentum, de quo supradictum est suspensorium capitis femoris tanti roboris est ut non luxaretur in homine ex pedibus suspenso etiam si capiti libras mille appenderis; quare *nullam unquam luxationem femoris a causa externa fieri posse*, &c. BOERHAAVE.

Experimentum habet Fernelius "Comitis Sebastiani qui Lugduni vix a quatuor incitatis equis discerpi potuerit. HALLER.

|| Dictus Magister Borst, qui in suo officio uberiores habuit occasionem anuum cadavera aperiendi mihi

To this opinion of fracture being infinitely more frequent than luxation, Boerhaave, as I have already intimated, set his seal in the most deliberate and formal manner, after reviewing all that the others had done. This closed the dispute, and I must say, most unhappily for the public. Let it once be supposed that the thigh bone can only be fractured, and all other accidents of the joint will be utterly neglected. That all the other accidents, and especially luxations, have been so neglected, especially in Holland! that many whose thigh bones should have been reduced, had remained lame and miserable for life, is most unhappily proved by the splendid museums of Ruifsch, Hovius, Vandoveren, Albinus, and Sandifort. But these are melancholy proofs, and indeed we have little reason to dwell upon them, for the reproach is universal, and our surgeon Cheffelden also gives drawings of unreduced luxations. This opinion, that luxation could not happen, was received here in England chiefly on the authority of Boerhaave, and prevailed so much, that even to the present day, in the various collections of cases, we find numerous examples of the luxation of the thigh, and wonder why such insignificant cases, so uniform, and all so like each other, should be at all received into collections; they are related merely to prove that luxation of the thigh is not impossible, as Boerhaave affirmed!

But I make my appeal neither to Paræus, nor Ruifsch, nor Boerhaave, but to the structure of the joint itself; to that I return as the surest guide, while the opinions of authors serve but as accidental illustrations. It is from the insecure state of the epiphysis in children*, from the singular thinness of the neck of the thigh bone in old age, from its transverse position, together with the hazardous leaps and falls of men in the prime of life, that this part is exposed to fracture. To speak impartially, fracture is perhaps more common than luxation, though both are frequent.

WHY IS THIS FRACTURE INCURABLE?

The difficulty of reuniting the fractured neck of the thigh bone has been too long acknowledged to be questioned at this time†, and the peculiar condition of this

retulit sese octies aperuisse anuum claudicantium cadavera, et semper invenisse ossa in collo fuisse fracta, et ne ullum quidem ex-articulatum.

* The Epiphysis are the cartilaginous heads and processes of the bones which in children are distinct parts easily separated from the shaft or body of the bone, and which are firmly united with it only in the adult.

† Celsus also gives his testimony to the difficulty or impossibility of effecting a cure. *Neque tamen igno-*

part of the bone, accounts too well for all our disappointments. The celebrated Deseault was full of expectation of accomplishing the cure of this fracture: "Why (says this excellent surgeon), since the bony matter forming the neck of the thigh bone has nothing peculiar in its nature, why should not this fracture heal like that of the other parts of the same bone?"† The reasons are many, and not uninteresting.

When a bone is broken, the soft parts are thickened around it; there is a general soft swelling of the limb, accompanied with a particular tumor surrounding the fractured part, which tumor is hard and firm, and feels as if there were formed round the bone, a gland-like mass for the purpose of generating callus. When we break the leg of an animal, and examine this thickening, we find the muscles, the cellular substance, and the periosteum thickened, and firmly adhering to the ends of the broken bone, the part is very vascular, and it would appear that this turgescence, swelling, and high action of the vessels, were determined to the generation of bone, which being generated, the action subsides, and the swelling and thickness dissolve.

When we take a bone broken twenty years, for example, before the person's death, and inject its vessels, we find that the same connection of the vessels still subsists, that from the vessels of the periosteum the injection penetrates the callus more freely than any part of the bone.

When a bone dies (which death of the bone we term Necrosis), the first accident that ensues is separation of the periosteum from the dead bone, inflammation of the surrounding parts, a swelling, hard, firm, and limited expressly to the necrosing part of the bone; the hardness exactly resembles that of a recent callus; and the issue of this process is, that the active state of this mass forms a new bone, in the centre of which the dead bone remains enclosed.

We find it essential to the reunion of a fractured bone, not only that the ends of the bone should be alive, and should have each the inherent power of producing new bone, but that the two broken parts of the bone should be united in their office, that they should actually adhere, that their vessels should mix, that

rare oportet, si femur fractum est fieri brevius; quia nunquam in antiquum statum revertitur summisque digitis postea cruris ejus insisti, sed multa tamen femoris debilitas est; si vi fortunæ negligentia accessit. Lib. viii. cap. x.

† Si la matiere osseuse qui forme le col du femur n'est pas d'une nature particuliere pourquoi sa fracture ne gueriroit elle pas comme celle des autres parties du même os; lorsqu'elle est reduite et contenue par des moyens efficaces? et pourquoi seroit-elle suivie d'accidens extraordinaires? Page 353.

they should support each other ; and on this account, wherever bones are healing prosperously, you can distinguish outwardly that swelling of the parts by which they are held together in this posture of adhesion.

When the tibia and fibula, the radius and ulna, or any other well supported bone, is broken across, the surrounding parts, muscular as well as cellular, are lacerated ; and by the inflammation of the cellular and muscular substance, in concert with the periosteum, that mass is formed, which by the activity of its vessels, works the blood towards the immediate fracture ; and though we cannot say, that any organization but that of the bone itself is directly capable of regenerating bone, yet we plainly perceive the necessity of this thickening of the surrounding parts, which is like a temporary gland instituted for the purpose of secreting bone.

Now, when the thigh bone or tibia is broken (supported as they are by surrounding parts), there is a great inflammation and thickening of the surrounding flesh, by which is formed a large and firm callus. But when the rotula or knee pan is broken, we have to do with a bone which is in very different circumstances. The muscles of the thigh are indeed implanted into the rotula, but they are implanted at its edge ; except at its upper edge, no fleshy part touches the bone, it has no medullary canal, no remarkable vessels ! this bone is connected with the tibia below by a strong and hard ligament, its sides receive the tendons of the vasti muscles, its inner surface is lined with the delicate capsule of the knee joint, the bone, indeed, lies properly within the joint, and is covered on its external surface only by the broad fascia of the thigh. This bone is insulated, floating upon the surface (as we may express it) of the knee joint, connected only with ligamentous and tendinous parts, and is excluded by the expansion of the fascia from any connexion with that softer cellular substance which lies under the skin ; it is of all the bones in the body the least supported by surrounding parts, the least apt to reunite. Of forty broken patellas, examined by Callisen and Camper in the various museums of France, Germany, England and Denmark, not one was perfectly reunited. The patella, when broken, is joined only by a ligamentous substance, long or short, according to the circumstances of the fracture, or the dexterity of the surgeon.

When the patella is fractured, a singular puffy emphysematous-like swelling rises instantly over the knee ; it feels absolutely as if the parts were inflated with air. The swelling is very great, but very soft. In no stage of the cure can we

observe any knotting or massing of the parts round the fractured bone; never was there an exuberant callus known to shoot out around a broken patella. The only two patellas which are actually united are in the possession of the ingenious Dr. Sheldon; yet even in these there is a distinct line of imperfect ossification traversing the patella, and marking the fracture.

From these facts, what should we conclude? Surely this, that a complete reunion of the patella is almost impossible; the defect exists in the part; the surgeon cannot be blamed *, though we may, if we choose, accuse Nature of a manifest imperfection.

When the neck of the thigh bone is fractured, the capsule sometimes remains entire; the capsule is of an insensible nature, entering very slowly into action; and within that ligamentous and insensible capsule is included the whole length of the neck of the thigh bone. The neck is surrounded with mucous fringes, and the cavity in which it lies is lubricated; the periosteum and ligaments are slow in entering into action or inflaming, even where they are lacerated, but when they remain entire, they exclude all connexion of the fractured bone with the muscular parts. Thus, unassisted by any of the usual adhesions, the neck of the thigh bone is left to its own intrinsic powers; naked bone is opposed to naked bone, and not very regularly opposed, for the ends of the fractured cervix are so obliquely placed

* Mr. Sheldon, in his Essay upon the Fracture of the Patella, quotes the following passage from Mr. Benjamin Bell: "I must likewise object to Mr. Bell. He says, in his System of Surgery, It is a fortunate circumstance, however, that it is not absolutely necessary to a complete cure that the different pieces of bone be kept in exact contact. Where it can be easily done, it ought always to be put in practice; but I know from the result of several cases where THIS was impracticable, that a cure may be obtained, and the joint be equally firm and USEFUL as IT was before, even although the separated portions of bone cannot be brought within an inch of each other. We should not, therefore, be very anxious about THIS; and instead of using much force for the purpose of drawing the bones into close contact, no more should be employed than the patient can bear with PERFECT EASE."

"Whoever (says Dr. Sheldon), follows Mr. Bell, and does not bring the fractured portions of the patella into accurate contact, which may always be effected by bending the hip joint, and bringing down the extensor muscles, and superior fractured portion, without giving that pain which Mr. Bell says is produced by attempting to bring the fractured portions into accurate contact, WILL UNDOUBTEDLY LAME HIS patient." This remark of Dr. Sheldon's is a piece of honest English furliness, in which he should not have indulged; he should have considered how much Mr. Bell writes at a venture, and so have excused him for this opinion, if opinion it can be called; he who made the patella could not make a mended one as good as a sound one, much less could Mr. Benjamin Bell. I believe I have assigned a reason why a perfect cure is almost impossible.

with regard to each other, that more than the usual callus would be required for their reunion ! and yet they are so entirely deprived of any support from surrounding parts, that less callus is produced, often none ! they frequently remain disunited *.

The neck of the thigh bone, which is completely insulated in its natural condition, can form, when broken, none of those connexions with the surrounding parts which should help to make up a mass capable of retaining the bones in close contact, and of assisting in the generation of callus. This is the reason why all our ingenuity is exhausted in vain, why each successive generation has condemned the inventions of the preceding age. All our hopes of succeeding in the cure of fracture in the neck of the thigh bone have been successively abandoned, and we are almost persuaded to subscribe to the bold unlimited affirmation of Platner, “*Nunquam os ea parte glutinari posse nec membrum in antiquum statum reverti.*” The mechanism I have explained is, I fear, a true answer to the question of the celebrated Deseault, “*Why should not the neck heal like any other part of this bone ?*”

But why is the neck of the thigh bone, when it does reunite, surrounded with so clumsy a mass of callus ? This also must be explained ; for it is a fact, and an interesting one, and must have a place in the account which I am presently to give of the various conditions in which the fractured thigh bone is found after death.

There are just two conditions in which the thigh bone will be found after a fracture of its neck. Along with the fracture of that part of the limb, there may either be much shortening of the limb, or very little ; there may be a wide laceration of the capsule and surrounding parts, or none at all ; and these two varieties of the fracture draw after them very important consequences.

Suppose a man to miss a landing place, and for want of light, go over a staircase perpendicularly in the attitude of walking forward ; suppose him to fall into an unrailed area, or to drop desperately from a window, upon the cry of fire ; he

* Every where this fact is acknowledged, often in such expressions as these, “*Le cal de femur ne paroît pas propre à fournir le matière du cal.*” *Memoires de Chirurgie.*—But I find nothing like an explanation of this fact, unless, perhaps, something like one were to be picked out of a transient expression of Parez, who says, “*La fracture faite pres des jointures est plus malaisément guarrie, pource qu’a cause des nerfs, tendons et ligamens, communs elle apporte de plus grands accidens ET QUE CE LIEU EST EXANGUE.*” PAREZ, p. 343.

That THE PART IS BLOODLESS, that the surrounding parts are little able to contribute their share in the cure, is the very TRUTH.

breaks the neck of the thigh bone, is sensible of what has happened to him, and waits the people coming with light. Here the patient lies without struggling, is carefully lifted by his friends, and is put into the surgeon's hands, with very little shortening of the limb. In such circumstances, the thigh is so little shortened, that the surgeon is at a loss at first to ascertain the nature of the accident; and if such patient die of fever, or if the other injuries prove the fall, the capsule is found entire, inflamed, full of serous effusion, and red with the high action of its vessels, though not lacerated.

But if the man, being stunned by his fall, be insensible of all the injuries he may have sustained; if, when his friends first raise him, he strive to stand upon the fractured limb; if a man, being pursued, take a desperate leap, and after fracturing the neck of the thigh bone, still struggle to get on, and actually walk upon the fractured limb; if a drunk man fracture his thigh bone, and be raised up by his reeling companions, or by the people accidentally passing, and unconscious of the man's situation; if he stagger forwards upon the broken limb, the surgeon is sure to find it remarkably shortened, it is at least four inches shorter than the sound limb, the trochanter and broken neck of the bone are pushed upwards, the capsule completely torn, the cellular substance disordered, the muscles lacerated and displaced, while the broken part of the bone is buried deep in the midst of this laceration.

The import of those distinctions is greater than you may at first imagine. There are two conditions of the fractured bone; the one resembling the unsupported condition of the patella, the other resembling the condition of the tibia, or radius and ulna, where there is a great mass of surrounding muscles connected by cellular substance with the bone.

First, When the capsule remains entire, the limb is little shortened, the ends of the broken bone are indeed but little displaced, but then they are little capable of reunion. The whole joint is inflamed, the lubricating liquor is poured out in great quantities, so that the cavity of the joint is preserved, and even enlarged; the broken parts remain insulated; the capsule, hard and insensible in its nature, enters slowly into disease; the effusion enlarges the cavity of the capsule, all its thickening is outwardly (in respect to the cavity of the joint), so that even the hard and insensible capsule never approaches the fractured parts of the bone. The two ends of the broken bones pass each other, and are not supported nor connected together by the adhesion of the surrounding parts. They are not regularly opposed to each other, and though they were, they would be like the opposite

pieces of the broken patella, very unfit to unite with one another; they would be opposed naked to each other, bone to bone, and if they did unite, their union would be like that of the patella, ligamentous and imperfect.

It was only after considering the circumstances a good deal, that I could persuade myself of this part being ever in any instance fractured without a laceration of the capsule; but I find many evidences of this important fact. There is especially one very accurate dissection of Mr. Dessault's, which I will recite to you. It was the dissection of the hip joint of an old woman, who having fractured the thigh bone by a fall, died the 45th day after. Her thigh had been little shortened, no more than an inch and a half; the cellular substance belonging to the muscles surrounding the joint was thickened; the capsule of the joint was firmer and thicker than it naturally is, and enclosed a quantity of bloody serum; the round ligament was torn away from the ball of the thigh bone; the bone was in part also uncovered of its cartilaginous shell, and had begun to granulate; the round ligament, almost entirely separated from the head of the thigh bone, had spread itself in the bottom of the socket; and the fractured neck of the thigh bone was united by a fibrous substance*.

This bone then was reunited, not with callus, but with something flexible like a ligament, resembling the substance by which the pieces of a fractured patella are joined! with what Dessault terms a *fibrous production*. Whether the bone might have entirely reunited in the end, is still a question; and this only is left certain, that very frequently the process fails, that the ends of the bone continue

* "Le tissu cellulaire qui unissoit ces muscles près de l'articulation étoit plus dense qu'il ne l'est ordinairement. Le ligament capsulaire, qui avoit aussi plus de densité et plus d'épaisseur que dans l'état naturel, renfermoit un peu de fluide sanguinolent. On observoit à la partie inférieure et interne du ligament rond, près de son insertion, une petite portion de la tête du fémur dénuée de son cartilage et couverte de bourgeons rougeâtres. Le ligament rond lui-même presque entièrement détaché de la tête de l'os, s'épanouissoit le fond. Le col du fémur étoit réuni par une production, qui avoit l'apparence fibreuse: cet os avoit d'ailleurs sa longueur et sa direction ordinaires." DESSAULT, p. 344.

There are some things in this dissection especially worthy of remark. 1st, The thickening of the capsule, and the strengthening of it by the surrounding cellular substance. 2d, The proof of the round ligament serving really and truly the purpose of a ligament, and resisting the force of the blow, retaining the head in the socket. 3dly, The ligament, when it is torn partly away, sinking down into the socket, expanding there, as Dessault expresses it, and accounting for the thickening of the parts within the socket, and causing that singular lengthening of the thigh bone which I have mentioned as an accident of luxation. And, 4th, The imperfect reunion of the neck of the thigh bone, and the sparing callus with which the parts are joined.

unconnected and loose, and rubbing upon each other with every slight motion of the joint, cartilages soon cover each end of such a fractured bone, and an unnatural joint is formed, feeble, and almost useless.

Secondly, It should be observed, that in every oblique fracture, where the bones overshoot each other and tear the muscles, the adjacent parts are engaged in the disease, the mass of parts affected by the injury is great, and the quantity of callus or new bone is proportioned always to the obliquity of the fracture; so it is in this fracture of the neck of the thigh bone. When the patient, unconscious of the terrible accident which has befallen him, strives to rise, attempts to walk, rests the body upon the broken bone, and even falls forwards upon it, the upper part of the fractured bone is driven through the lacerated capsule, the muscles are displaced from their beds upon the back of the haunch bone, and the limb being shortened four inches, that difference of four inches in the length of the limb, lodges the broken bone fairly among the lacerated muscles, or rather among the cellular substance which belongs to those muscles. Then the slightest motion of the limb gives exquisite pain, the patient is fearful of the slightest change of posture, both the surgeon is fearful of moving the limb, and the patient is unwilling to have it moved; there the broken bone lies forming new connexions and strong adhesions, and a great mass of parts is drawn into consent. Now, it is this which helps to make up so large a knot of callus. Look to the drawings of whichever museum you please, of Chesselden, Sandifort or Ruisch, you will observe, that where the limb has been preserved nearly of its natural length, the callus is very sparing, and often the union of the neck of the bone has failed, the neck of the thigh bone has been entirely destroyed, and an unnatural joint formed; while on the contrary, a clumsy callus, or, as the older writers express it, a profusion of ossific matter, is always connected with a shortening of the limb.

We may thus deduce the difficulties of this kind of fracture from causes very different, from the imperfection of our machines. We perceive that the fracture of the neck of the thigh bone must be desperate in order to be cured. We are sensible that if the limb be but little shortened, and the broken bone surrounded only by its capsule, and very slightly lacerated, or not at all, the parts surrounding the broken bone being incapable of adhesion, unfit for the necessary process of generating bone, the callus will be imperfect, the bones will continue to move upon each other, an unnatural joint will be formed, and there will be only a thickened capsule and condensed cellular substance for the whole weight of the body to hang upon.

But if the limb be much shortened, and the fractured bone driven deep among the lacerated flesh! out of the surrounding parts will be formed, a great vascular mass. The bone will be thoroughly reunited, but with a very clumsy callus, which will cause lameness, as remarkable to others, though less wearisome or painful to the patient himself, as that where the unnatural joint is formed; for the limb is, in the case of a large callus, shorter and more awkward and more limited in its motions, but it is withal firmer, better supported, more hardy and useful. In short, the whole subject draws itself naturally into this plain conclusion; in fracture of the neck of the thigh bone there will be either too big a callus, or none at all, and the perfect cure of this accident is almost impossible. If there be any truth in those conclusions, the facts of pathology should confirm them; nor can any subject of inquiry be more interesting than the derangements of parts which have made thousands lame and miserable. Allow me, then, to explain to you as briefly as possible, the various conditions in which the fractured thigh bone is found upon dissection.

1st, Where the capsule remains entire around the bones, this effect will generally follow: The action of the living powers in the two parts of the bone being unsupported by any continuity of vessels, will soon subside; the ends of the bone, in place of spreading out into broad surfaces, will shrink and become extenuated; it is said, in such case, that the neck and shaft of the bone are absorbed! so they are, but they are continually absorbed! During every moment of our existence each part of the bony system is in a state of continual absorption, and new parts are as continually depositing; it is only when the absorbed parts are not replaced, or, in other words, when the vessels of a bone fail to nourish it, that it shrinks and is wasted*. The upper part of the shaft of the bone then having lost its continuity no longer retains its size, the neck entirely disappears, the two ends of the bone become small, are rounded off, are tipped with cartilage; the capsule strengthens in proportion to the pressure it suffers; the head of the thigh bone remains in the socket, its neck is in part or entirely absorbed; the upper part of the bone, where the neck was broken, is covered over with cartilage, the joint which is formed is

* This the older surgeons ascribed to friction: Hanc vetulam non solum claudicasse ad vitæ terminum verum etiam in cadaveris apertione inventum fuisse dicti ossis collum in totum deficere et in nihilum adeo fuisse redactum ut nihilum quidem remanserit Gerardus Borst, chirurgus Amsteladomensis satis expertus qui cadaver præsentibus variis medicis et chirurgis liberalitate sua museum meum illo objecto adornavit.

imperfect, lame, and unserviceable.—From such a limb the body has no other support than by the haunch bone hanging very uneasily by the thickened capsule upon the top of the thigh bone.

This is very frequently the condition of old women, whose thigh bone being thin in the neck, is easily broken. The awkwardness of their clothes trips them, their fall is awkward, so as to break the cervix femoris, without pushing it deep among the muscles. This condition of the parts is known after the recovery of the patient, by the shortening of the limb, by a clucking noise when the bones move upon each other, like the crackling of the joints when twisted (as in champing the fingers), by the entire lameness, and by the frequent accessions of pain, for every joint so injured becomes rheumatic.

2d, When in consequence of great violence the capsule is completely torn, the limb remarkably shortened, and the broken end of the thigh bone pushed upwards among the muscles, there is often a great massing of parts, and a large callus; but if the broken trochanters of the bone are pushed far beyond the neck of the bone where it projects from the socket, if the broken part of the neck be opposed to the shaft low down where it is uninjured, no ossification will take place, no connexion betwixt the neck and the shaft of the bone will be formed. The upper part of the broken thigh bone then rests against the back of the haunch bone; it lies where the head of the thigh bone does in luxation, and obtains just such a union as the luxated bone does. The haunch bone is fretted and inflamed, and begins to form a flat socket-like surface; the upper end of the thigh bone also flattens, and sometimes enlarges, while the surrounding cellular substance condenses into the form of a capsule. Such a limb hangs very high in air, it is much wasted for want of use, and entirely lame.

3d, When the upper broken part of the thigh bone (that broad surface I mean which is betwixt the two trochanters), is directly opposed to the broken neck, has a strong disposition to form callus, and yet is hindered by motion from uniting, and the friction keeps the vascular system of both bones in an active state; first, the head and neck of the thigh bone adhere with the socket, in which they remain, and form one mass with it; that mass gets a broad, flat, unequal surface; and that surface is opposed to a similar one on the face of the thigh bone, betwixt the trochanters. Both surfaces (both that of the conjoined cervix and acetabulum, and that of the top of the thigh bone), are covered with cartilage; the inequalities of one bone correspond with those of the other, and by the help of the original capsule much thickened, together with condensed cellular substance, a strong

ligament is formed, and a flat and shuffling joint is completed, without the upper part of the bone being much displaced, or the limb much shortened, as it always is where the femur is lodged upon the back of the ilium.

4th, Even when the thigh bone is in the most favourable situation for a cure, when the capsule has been torn, when the capsule has entered with the other lacerated parts into inflammation, and has adhered to the bone, so as to support its broken ends in contact with each other, the two ends are not regularly opposed, the neck of the bone remains in the socket, the broken part of the bone, which should be opposed by it, is retracted by the force of the muscles; the neck adheres, indeed, to the shaft of the bone, but it adheres with it at right angles; and the shortening of the limb, which is produced at first by the contraction of the muscles, is perpetuated by the manner in which the broken pieces unite; in short, the neck of the thigh bone sliding down, as it were, lower upon the shaft, unites with it at right angles, and by losing all its obliquity, loses four inches of its length.

5th, But it is not alone by the abridgment of its length that the limb is curbed in its motions; the motions of the thigh are checked by two very singular causes. The length and obliquity of the neck of the thigh bone are chiefly designed for holding off the trochanters from the haunch bone, and are essential to the free motion of the joint; and consequently when the obliquity and length of the neck of the thigh bone are lost, when the neck, being almost destroyed, the head of the bone is united close to the shaft at right angles, when the trochanter towers above the head of the bone, and is in actual contact with the haunch bone; when the trochanter is still farther surmounted with a large irregular callus, and when the shaft of the bone lies flatter and closer upon the haunch bone, and rolls with smaller circles, the motions of the joint become short and imperfect; the motion is, indeed, so checked, that the joint feels as stiff as if ankylosed; and you are sensible, upon moving the joint, of the irregular callus chucking against the haunch bone. I have seen a young man in whom this 'chucking' of the bones was very audible, and the joint, though not ankylosed, was so curbed in its motions, that when he made a step, in place of moving the limb, he advanced that side of the pelvis, and turned the trunk; the leg meanwhile being little shortened, not at all wasted, but firm and strong.

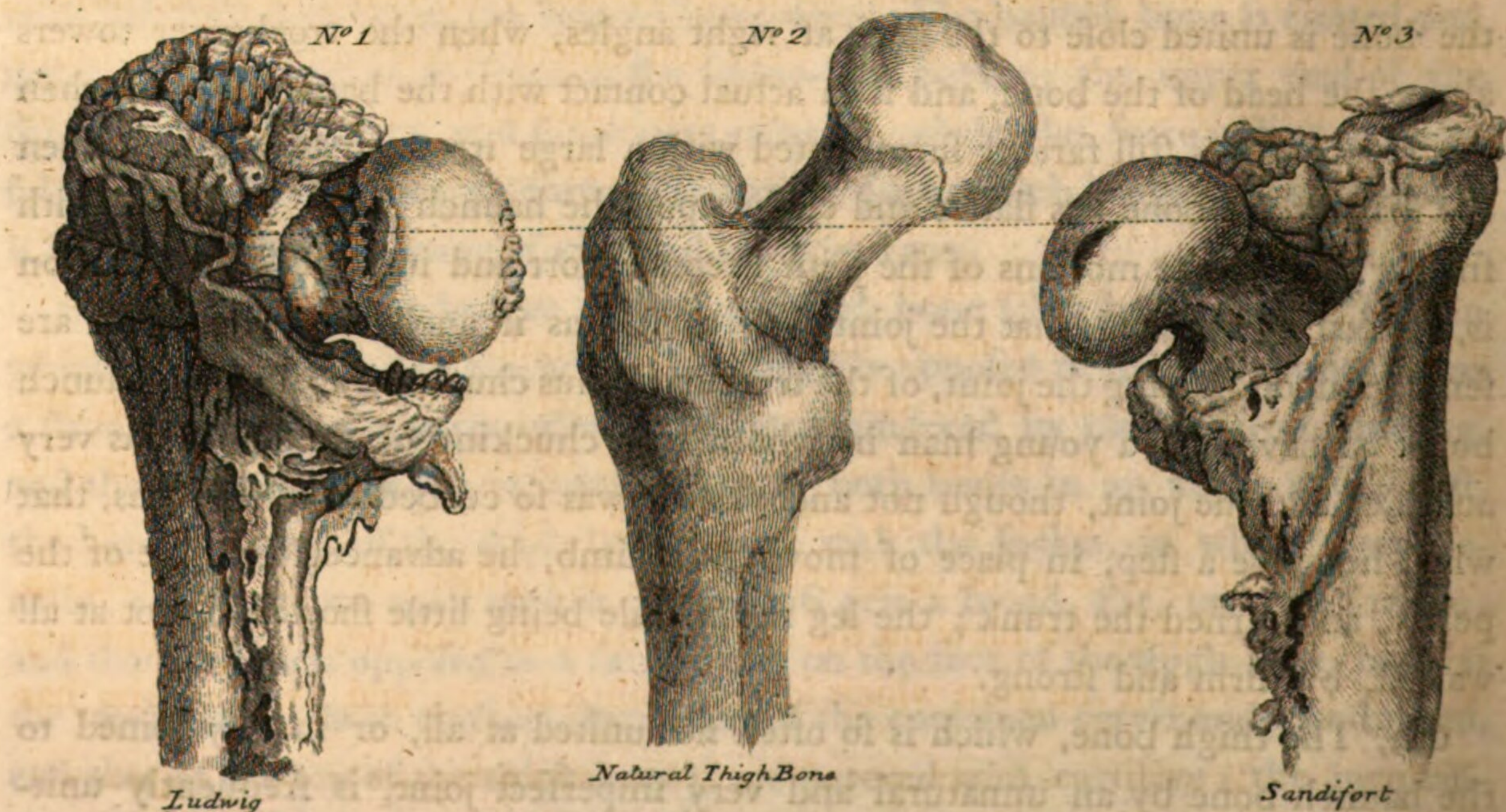
6th, The thigh bone, which is so often not united at all, or merely joined to the haunch bone by an unnatural and very imperfect joint, is frequently united with the pelvis immoveably by ankylosis. Both bones (the trochanter and

the haunch bone), being hurt, both being in a disposition to generate new bone, connected at the same time by the adhesion of the surrounding parts, and kept steady to avoid pain, unite with each other by a broad surface, by a perfect continuity of vessels, they become as one bone; the joint, and even the socket, are entirely annihilated; the limb is in general remarkably shortened, hanging in the air, and wasted by want of use.

This may serve to explain some of the appearances of disordered joints, and may serve as an outline or hasty sketch of the pathology of the fractured thigh bone †.

† These drawings explain abundantly well the consequences of this depression of the head of the thigh bone. We see plainly, upon comparing the two broken bones with the outlines of the sound thigh bone, No. 2. placed betwixt them, how much the neck of the thigh bone, by losing its obliquity, loses of its length; how much also, as in fig. 1. from Ludwig (one of the earliest writers on this interesting subject), the motions of the limb must be embarrassed by the projection of the trochanter; and lastly, it must be remembered, that often, as in No. 3. the head of the bone is not only set lower down, but turned round, with regard to the shaft of the bone, as is explained in the following note concerning the case: "*Femoris ossis sinistri pars superior est. Fractura colli adfuit obliqua, deorsum per partem corporis sese extendens. Partes sic concreverunt, ut caput loco admodum demisso conspiciatur, et simul tantopere retrorsum recesserit, ut ex partes ossis quæ sano statu a parte posteriore inveniantur, nunc in parte laterali externa dentur.*"

SANDIFORT.



PATHOLOGY OF THE DISEASED ACETABULUM, OR AFFECTION OF THE SOFT PARTS WITHIN THE HIP JOINT.

Luxation of the thigh bone is usually produced by a strain or twisting of the limb; fracture of the neck of the bone is usually produced by perpendicular falls or leaps, in which one leg bearing, either directly or obliquely, the whole weight of the body, the stress falls upon the neck of the bone, which breaks across: But the disease I am now to describe proceeds from a fall upon the haunch (as when the foot slips on ice, &c.) in which the trochanter being directly struck, the head of the thigh bone is beaten down into the socket, the round ligament, which occupies the bottom, and the mucous fringes, which are contained rather in the lower part of the socket, are violently bruised, whence arises immediate and very terrible pain, continuing for many months. The torture is excruciating, the patient cannot be turned, nor even moved, in the most gentle manner in bed; after, perhaps, a year's suffering, he begins to move about upon crutches, entirely lame.

This disease of the acetabulum is peculiarly frequent in people advanced in years. We must impute their sufferings to the bruise of the soft and delicate parts which lubricate the joint. The consequences are very deplorable, for it is from this cause that we see so many old people lame and miserable for the remainder of their lives. It is almost peculiar to those advanced in years, because, during the active stage of life, the dangerous leaps and violent falls and strains of the limbs more frequently dislocate or fracture the bone; and in such accidents, the head of the bone being driven upwards against the upper and deeper part of the socket, the mucus, ducts and soft parts which lie in the lower part of the socket, suffer no harm. But in old age, the slightest slip occasions a fall, the fall is upon plain ground, yet the fall is very heavy for want of that agility and strength that might break the force of the fall, or change its direction; the haunch is struck, the blow is direct upon the trochanter, and the head of the bone is driven directly downwards into the bottom of the acetabulum †.

The disorder never can be confounded with any other: No one who has in his own person suffered a blow on the knee or haunch, can doubt the sensibility of those parts within the joint which serve to lubricate it; and no one who has

† From the awkwardness and entanglement of their clothes, such accidents are peculiarly frequent with old women.

observed the number of large arteries which enter into the knee joint, for example, at its sides or back part, or which enter into the hip joint under the ligament in the open part of the acetabulum, can doubt their vascularity or susceptibility of action. This accident then is attended with excruciating pain, and is clearly distinguished from fracture, because there is neither crepitation nor shortening of the limb; from luxation, because the limb turns easily; and from those and all other affections by this, that though it turns easily, and there is no mechanical obstruction to motion, the patient cannot suffer it to be turned, every motion of the head of the bone rolling against the injured parts of the socket producing delirious and frantic outcries. Sometimes this inflammation of the joint subsides, and after long confinement and torture, perhaps after using warm baths, frequent watering places, fomenting and gradually exercising the joint, the patient recovers the use of his limb; but much more frequently he continues lame.

It is not difficult to imagine, and indeed to prove by dissection, various changes by which the joint is destroyed. The first effect of such inflammation and insufferable pain is, to produce a trembling solicitude on the part of the patient to prevent the slightest motion of the limb. The patient lies in all the filthiness of a sickbed, will not permit a pillow to be changed, or a sheet to be rolled under him; even the trembling of the floor, when people walk rudely, increases his irritability, if not his actual torture. This is almost like a provision of Nature, for motion actually does harm, excites inflammation, brings the inflammation forward to abscess of the joint and caries of the bones, and prevents ankylosis, which is often the only possible cure; the presumptuous interference of quacks with the process of Nature, their daring to twist and turn such a limb, under the pretext of reducing luxation, has actually proved fatal.

The stillness of the patient, like death, and the uniform posture for many months, favours all those changes which are apt to take place in a joint thus highly inflamed. Sometimes the inflammation stops short of ulceration, the capsule, tendons and membranes surrounding the joint, are merely thickened by the inflammation, and the joint remains stiff, rheumatic, but moveable, and, as far as pain will allow, useful. Sometimes, and especially in younger people, the inflammation runs high, abscess forms, and after repeated paroxysms of inflammation and most excruciating torture, the matter bursts out at the haunch or in the groin, with proportioned relief of pain. Often, you may suppose, before the matter thus bursts out, the bones themselves are ulcerated, the capsule is destroyed, the head

of the bone is extruded from the acetabulum, and retracted by the force of its muscles upon the back of the haunch bone; then the leg is shortened; and this is what the ancients called Subluxation, the French, Luxation Consécutive, and which has been by almost all surgeons acknowledged as a luxation under the title of Luxation from an Internal Cause. Often the bones, thus eroded, become carious, and not unfrequently hectic ensues, and the patient dies.

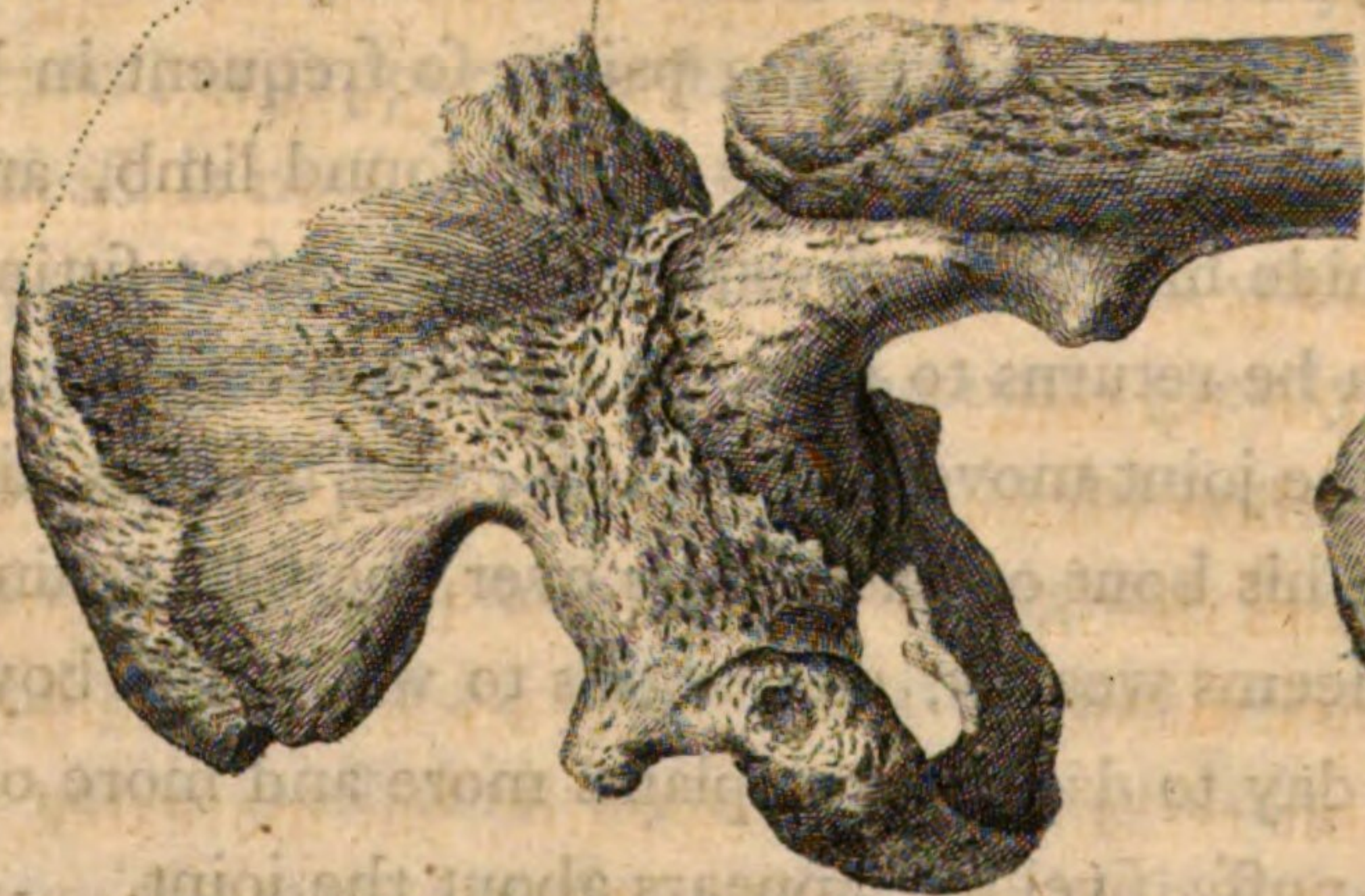
If, escaping all those dangers, the patient live, and the bones granulate, they unite with each other; for the persevering posture of the patient prevents the process of ossification being disturbed, more effectually than our most severe and curious bandages could do; the bones unite with each other often in the most awkward direction, the thigh bone being fixed and united with the pelvis at right angles in respect to the body. But even although the bones be not entirely eroded, I observe a very singular consequence to result frequently from the mere inflammation of the periosteum and bones, and it is this; the bones thicken, there is a sort of exostosis, but flat and regular, a new lamella of bone is secreted under the periosteum! and you will often see, in museums, the head, for example, of the thigh bone covered, as it were, with a cap of newly-secreted bone projecting over the neck, and almost touching the trochanter; indeed it does not seem to me that any thing is necessary to this regular and almost natural generation of bone but a slight degree of inflammation, and a fixed posture of the limb.

*Depression of the Cervix
without fracture.*



L. Bell.

2



*Ankylosis - with the Thigh
projecting forwards.*

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4 B ij

*Cap of newly
secreted Bone.*



M. L. J. S. Sulp.

Once

Once more let me observe, that I ascribe this disease to old people, because they are subject to those awkward falls in which the great trochanter is struck; but let it be remembered, that sometimes in the aged the bone is broken, though very seldom luxated, by this blow. I also distinguish this as a disease of those advanced in years, because the aged are not liable to a peculiar disease of the bones themselves, which I shall now describe.

OF THE SCROPHULOUS DISEASE OF BOYS, OR THE DISEASE OF THE BONES WHICH COMPOSE THE HIP JOINT.

The scrophulous disease of this joint is peculiarly frequent in boys from five to eighteen or twenty years of age, and is of that insidious nature, that its approach is hardly observed; the disease is established before its symptoms are noticed, even by the most affectionate and attentive parents, and it ends in total caries of the joint, with ankylosis or cohesion of the diseased bones, though often, from the suppurations and dreadful pain, hectic and death prevent this imperfect cure. The bones, and not the soft parts, are the seat of the disease, therefore its progress is very slow; the pain is so dull, that the boy walks and runs about for months after the disease is formed. The parents first observe an awkwardness and trailing of the affected limb, as if it were weakly; the boy complains little except of weariness after play, and of that numbness and stupor, with dull and heavy pain, which the parents mistake for growing pains, so frequent in boys.

The boy now begins to stand always on the sound limb, and in such a posture, that the parents chide him for awkward habits. After sitting a little while, his joint stiffens, when he returns to play, he begins to feel pain, when he is warmed with exercise, the joint moves more easily, and he runs his race with his play-fellows! but when his bout of exercise is over, he falls again into a state of languor. The limb seems weakly, and begins to waste, the boy loses his health and complexion, from day to day he complains more and more of pain, till at last he is confined, and a puffy swelling appears about the joint.

During all this stage of the disease, the bone is swelling and becoming more vascular, the lining of the acetabulum and the periosteum covering the head of the thigh bone, are thickened in common with the bones themselves which are now swelled. The head of the thigh bone is protruded in some degree from its

socket, just as a diseased tooth is protruded from its socket by a bag of suppuration forming under its fangs, by which the tooth is not only apparently but actually longer than the adjoining teeth. Still the disease is limited to the bones; there is not, as in the disease arising from bruises of the acetabulum, excruciating acute pain! although the leg be remarkably elongated so as to straddle away from the body, though it be so elongated that when the boy stands on the diseased leg the toes only of the sound one touch the ground, yet he is almost without pain, and walks with a degree of ease! exercise, or the common degree of motion, during this stage, is not so difficult on account of pain, as imprudent, from its increasing that affection of the bones which unhappily is too late of declaring itself by acute pain.

But at last the stage of acute pain does come; the boy becomes unable to move, the pain becomes very acute, the soft parts which connect the bones begin to partake of the inflammation; there is redness now, as well as swelling, round the haunch. The pain is often, though not always, excruciating; abscesses form round the joint; the matter bursts out, first at the groin, then at the hip! as the abscesses give vent to the matter, the torture is in some degree relieved, as one sinus or ulcer dries or closes up, another runs more plentifully, or new abscesses form. Then the cartilages are ulcerated, the matter which had distended the capsule is evacuated, and the swelling of the parts within the acetabulum, which had in some degree extruded the head of the bone from its socket, subsides, the head of the bone falls down again within its acetabulum! the limb, remarkably elongated at first, is shortened in this second or suppurative stage of the disease.

The cure of the disease is now to be looked for, or the patient's death. The patient, originally a puny boy, confined from play, wasted with suppuration, and tortured night and day with excruciating pain, becomes greatly extenuated; he is reduced to skin and bone, he is pale, and cadaverous in the face, the nose is pinched, the eyes staring from their sockets, and the face altogether shrunk and shrivelled up with discontent and pain. Often, the suppuration and caries extending along the bones, the whole pelvis is affected, the discharge is profuse, and the child dies of hectic; but sometimes the matter ceases to flow, the high inflammation subsides, the bones begin to granulate within like soft parts (as they indeed are in the boy extremely vascular), and by perseverance in one uniform posture, the bones unite, a proper ankylosis is formed, smaller suppurations are occasionally observed and opened, till at last the bones, after successive fits of inflammation, are entirely

united with each other. The thigh bone is generally united with the haunch bone at an angle more or less acute, according to the posture which the child had found the most easy; frequently it is found, when the boy begins to walk with his crutch, that the thigh protrudes forwards; sometimes it is in the natural direction of the body, but even then the limb hangs in air, it is extenuated by want of exercise and by disease; the diseased limb has been stationary in its growth for eighteen months or two years, while the other limb and the rest of the body has been growing; thence the affected limb is always shortened, and often useless.

This is the short and simple description of a melancholy and frequent disease, the chief peculiarities of which, as arising from the peculiar conformation of this joint, fall next to be explained.

In such a disease parents would fain deceive you, often they deceive themselves; it never is ascribed to any constitutional affection, but to a fall or blow in a rambling schoolboy, or, in a younger child, to the carelessness of a nurse. This is a mere deception; the curvature of the spine, for example, is always ascribed to some blow or fall, the spine bends outwards, one of the vertebræ becomes pointed, a particular tumor appears, it is very natural for the parents to imagine that this has been occasioned by a blow, and to accuse the nurse! but the surgeon knows that the curvature of the spine is an internal and a constitutional disease; it is an ulcer succeeded by a caries of the vertebræ; it is the body of the vertebræ (not of one indeed, but of several vertebræ) that is affected; the intervertebral substance and the ligaments are ulcerated, the bone itself is carious, the wasting of the vertebræ on their fore part makes them fall nearer each other, and it is because the vertebræ are found behind that they preserve their natural size, and bulge outwards, while the bodies of the vertebræ are ulcerated within. Thus a disease is usually ascribed by parents to a blow, which we know by innumerable dissections is actually produced by an internal ulcer, the surface of the bone supposed to be struck is in fact the only part remaining sound. What rambling schoolboy can escape blows and falls? yet the most desperate blows are followed by no ill consequence, except in those predisposed to disease.

Diseases of the bones and joints then are peculiar to boys of a scrophulous constitution; to boys who have a fair complexion, grey eyes, light hair, and a transparent redness of cheek; a swelled mouth, and puffy face, a large head, a tumid belly, clumsy limbs, with soft flesh which feels like wool; for scrophulous boys, when not under actual disease (then they become shrunk and pale) have a big

and fleshy body, and rosy countenance, which any uninformed person would mistake for marks of uncommon health and vigour.

This indescribable whole, which the physician easily distinguishes, indicates a lax and weakly system, the foundation of many diseases; the bowels and glands are especially apt to suffer, but the bones most of all. The scrophulous habit seems to consist in laxness and debility, in an imperfect action of the arteries, in an imperfect secretion of the solids, and especially in an imperfect secretion of the bony matter; for in all stages of life, but especially while the bones are a-forming, the bones suffer in various ways by this disease, which appears sometimes in the form of rickets, in which the secretion through the bony system, being imperfect, the bones bend, and are distorted, under the weight of the body; sometimes under the form of necrosis, in which the whole shaft of a bone dies, and is expelled through the abscess which its death occasions, while by the activity of the surrounding parts a new bone is forming, the dead being discharged piecemeal; and very often the general disease shows itself in affections of the great joints. Such as we are now explaining.

You will observe, I say, the "great joints," by particular design, for they only are affected. It is not from a blow or fall that the scrophulous disease proceeds, else we should easily trace it to its cause! it could indeed be no equivocal blow that could produce such a disease! we should find the disease as frequently in the wrist, the elbow, the shoulder, as in the joints of the lower extremity. But it may be that the disease is peculiar to the articulations of the lower extremity, because they support the whole weight of the body? No, for the ankle is rarely diseased, though it bears more weight than the hip or knee, and is fully as liable to twists, sprains, and blows. It may arise then from the injury or disease of the soft parts, since those joints are very complicated? No! for fractures, luxations, even bruises of the acetabulum, do not, either in adults or in healthy boys, produce disease.

This is plainly a disease, and a slow disease of the bones; it is a disease of boys, because in them the bones are but forming; it is a disease of scrophulous boys, because in that state of the system ossification is a slow and imperfect process; it is a disease peculiar to the bones of the great joints, because they are large, and are till the twentieth year very imperfectly formed.

The joints peculiarly subject to scrophulous affections are the spine, the hip, the knee. The KNEE is diseased less frequently, because, though it bear all the load,

and be in continual motion; though its bones, especially the heads of the tibia and thigh bone, be large and somewhat spongy, they are yet completed pretty early in life, and are comparatively firm and compact. The HIP is very subject to disease, because its acetabulum is formed in the centre of three of the largest and most spongy bones in the body, the joining of which is exactly in the centre of the acetabulum, and remains actually cartilaginous till the twentieth year. There is in the pelvis a great mass of bone to form, and it seems that till years of manhood it remains very imperfect; now, it is neither in the soft parts, in the central ligament, nor in the thigh bone, that the disease begins, but in this acetabulum*. The DISEASE OF THE SPINE is the most frequent of all, because the spine, while it supports the whole weight of the body, turns with the slightest inclination of the trunk, and consists of the most spongy bones, and it is in the most spongy part of these bones, in the fore part or body of the vertebræ, in that part in which the church-yard bone seems so porous, and which in the living body is almost as vascular as flesh, that this disease begins; and the matter making its way from the carious vertebræ along the loose cellular substance at the loins, appears at last at the groin forming the lumbar abscess; for the lumbar abscess is the same disease with caries of the spine.

The joints of the vertebræ, the knee, the hip, as they are the largest and bear the the whole weight of the body, are the most complicated with ligaments and lubricating apparatus, so that by being the strongest in the actual form of their bones and muscles, they have a peculiar delicacy of constitution, and are the most susceptible of disease. Upon those three joints then does the whole force (if I may so express myself) of this disease fall.

1st, That this is a disease of the bones, we are well assured from the lingering

* I have reason to believe, that often the acetabulum being entirely destroyed, the head of the thigh bone still entire passes through the hole up to that point at which it is naturally stopped by the trochanters. Ludwig, not observing how very liable this part is to disease, nor indeed perfectly acquainted with the scrophulous caries of the hip joint, imagined, that sometimes the head of the thigh bone, by the force of a fall upon the trochanter, was driven through the centre of the socket at the place where the bones are joined by their intermediate cartilage; but I shall spare my conjectures, and enable you to make your own, by laying before you the text of Ludwig. "*Aliter quam hoc in casu violentior impetus, femoris collo et acetabulo in puero novem circiter annorum illatus articulum mutavit. Ossa coxarum quæ nondum coaluerant in illata facile cedebant et ilium non nihil antrosum et introsum flexum inveniebatur,*" &c. But the whole description of the case corresponds with a disease which I shall describe presently, viz. the scrophulous caries of the hip joint, for the head of the thigh bone had coalesced with the acetabulum, &c.

nature of the disease, the little pain with which its first stage is attended, the period of life at which it occurs, and from boys and parents mistaking it for growing pains, for I have examined those carefully who have the mollities ossium, or the necrosis of the long bones, diseases which are always described by the patients as "dull and heavy pains of rheumatisms in the bone."

2d, The pains are dull because the bone is insensible, the disease slow because the firm system of a bone does not easily enter into disease; the elongation of the joint is a sure sign that the disease is established, and the head of the bone, the socket and the soft parts beginning to swell; the excruciating pain demonstrates that the soft parts are fully inflamed and ulcerated, and that to the original disease of the bone is now added a disease of the surfaces, such as takes place after the bruise of the acetabulum; and finally, the shortening of the limb intimates to us that the bones are wasting, which is often confirmed by small fragments and scales of bone coming away along with the matter. Finally, When the matter ceases to flow, the fistulas to close, the limb to shorten still more, and the pains to subside, then the bones come into actual contact, granulate, unite, and ankylose firmly in due time, for the hectic ceases, the appetite returns, and the cure goes on well, if only the patient can survive the degree of debility already incurred.

3d, This final destruction of the joint is the ordinary issue of the disease, for where the bones are once thoroughly diseased, they are in general carious, or in other terms, dead, or (as we should say of soft parts) gangrenous to some extent. The carious part then must be separated; the bones which enter so slowly into disease, must of course recover slowly; but besides the extent of surface, the disease is attended in its first stage with so little pain, the patient walks so long while the disease is forming, and the joint bears so entirely the whole weight of the body, that being once diseased it cannot easily recover; it is indeed entirely ruined in its structure almost before the disease is observed.

4th, The cure in the bruise of the acetabulum is leeches, fomentations, blisters, general bleeding, and perfect quiet; but in this scrophulous disease of boys, the cure is best conducted by cold bathing, generous food, wine, and whatever will contribute to the restoration of the health and strength. The immediate progress of the disease is best antagonized by the counter irritation of blisters, or rather of deep and large issues upon the hip, or by the application of cauteries (the oldest and perhaps the best method of cure), along with prudent openings,

and careful but unofficious surgery. But the object of chief importance in promoting the anchylosis, is to prevent motion, for even the weight of the limb is very painful, the very turning in bed inflames the part and interrupts the process; and quacks, by turning and twisting joints during this process (the patient being in a fair way of being cured), have caused death.

5th, When the disease cannot be prevented from going on to the suppurative stage, the consequences are, abscess of the joint, hectic fever, bursting outwardly of various abscesses and unavoidable ANCHYLOSIS. But let it not be supposed that anchylosis is the peculiar consequence of this disease, it proceeds occasionally from every affection of the joint, and sometimes even exists independent of disease. It is produced sometimes by luxation, the head of the thigh bone being placed upon the back of the haunch bone, the nourishing membranes of both bones lacerated and excited to granulate, and the bone being kept steady in this unnatural posture from fear of pain. Sometimes anchylosis is produced by fracture, the broken neck of the thigh bone being lodged close upon the back of the haunch bone among the lacerated parts. Sometimes it is produced by the bruise of the acetabulum, followed with inflammation, pain, and ulceration within. And sometimes anchylosis proceeds merely from the uniform posture of the limb when it is fixed by any other disease! I am indeed persuaded, that if we had legs and ancles to those thigh bones which we have in our museums, we should not unfrequently find the cause of anchylosis in the hip joint to have been a disease in some lower part of the limb. Still it must be acknowledged, that this scrophulous disease is by far the most frequent cause of anchylosis. We perceive then that the effects of disease upon this joint are never limited by the first cause, that the effects of disease are very irregular; that the surgeon cannot know what is going on within, without being acquainted with every possible affection of the joint †.

6th, During all this process, there is not that subluxation, that displacement of the head of the bone from an internal cause, which was supposed; there is never

† In the following passage we perceive that Petit, without understanding this process, had seen it often: "J'ai trouvé, dans l'ouverture d'un semblable abcès, que les os étoient *carnifiés*; je veux dire que la tête du fémur et la cavité de l'ischion, éloignées l'une de l'autre par la luxation, mais toutes deux découvertes par l'ouverture de l'abcès, avoient la même consistance et la même couleur que la chair. Le volume de ces os étoit considérablement augmenté, et ils étoient si semblables à la chair qu'ils saignoient au moindre attouchement. Cette observation n'est pas la seule que j'aie de cette espèce, j'en rapporterai, dans le suite, plusieurs qui ne sont pas moins surprenantes; et qui prouvent que si les chairs s'ossifient, les os peuvent aussi devenir semblables aux chairs."

that entire displacement which Mr. Petit supposed, when he asserted that the head of the bone falling into the sciatic notch pressed there upon the sacro-sciatic nerve, and produced paralysis by the pressure †. Petit formed a very ingenious theory to explain how the head of the thigh bone might be retracted so as to shorten the limb without being displaced from its socket, whereas he should have been employed in explaining how the thigh bone can be elongated, without the head of the bone being in any shape displaced either by being retracted or by being extruded from its socket; for we now perfectly know, that during that period of the disease in which the limb is elongated, the head of the bone actually never is luxated, it is right and fair in its socket, though both the head of the bone and the socket are swelled; it is indeed so fairly within its socket, that at the very time of its greatest elongation, when the toes of the sound leg can hardly touch the ground, the patient walks, and that pretty firmly too, upon the lengthened limb.

7th, When the period of ulceration, granulation, and healing of the bones arrives, a remarkable, but very gradual, shortening of the limb takes place, because the bones must first be ulcerated, then fall into closer contact, then granulate, and then adhere, before the ankylosis is complete. During the whole of this process the parts are wasting, coming closer and uniting, at least it most generally is so. I observe in ankylosis, even of the knee joint, where the bones are flat and the cartilages remarkably thin, that there is a very remarkable shortening of the limb.

8th, When such a suppuration and caries, beginning in the bones themselves, does happen, not in boys, but in adults, not from any constitutional disease, but from a blow, the blow is in a very particular direction, and affects only the bone; for it is not a blow upon the trochanter striking the head of the bone downwards, so as to bruise the soft parts at the bottom of the acetabulum; but it is by a person making a desperate leap and lighting fair upon the feet, for the head of the thigh bone is then struck upwards against the deepest part of the acetabulum, where the Os Innominatum is particularly large and firm! the bone only is bruised, there is no immediate pain, the lameness comes on slowly, the disease usually makes that slow progress which is described in the case related in the foot note from the Posthumous Works of Justamond ‡.

† La paralysie est causée par la compression du nerf sciatique, lorsque la tête du fémur y appuie. La maigreur et l'exténuation de tout le membre, un froid presque continuel, en sont les suites.

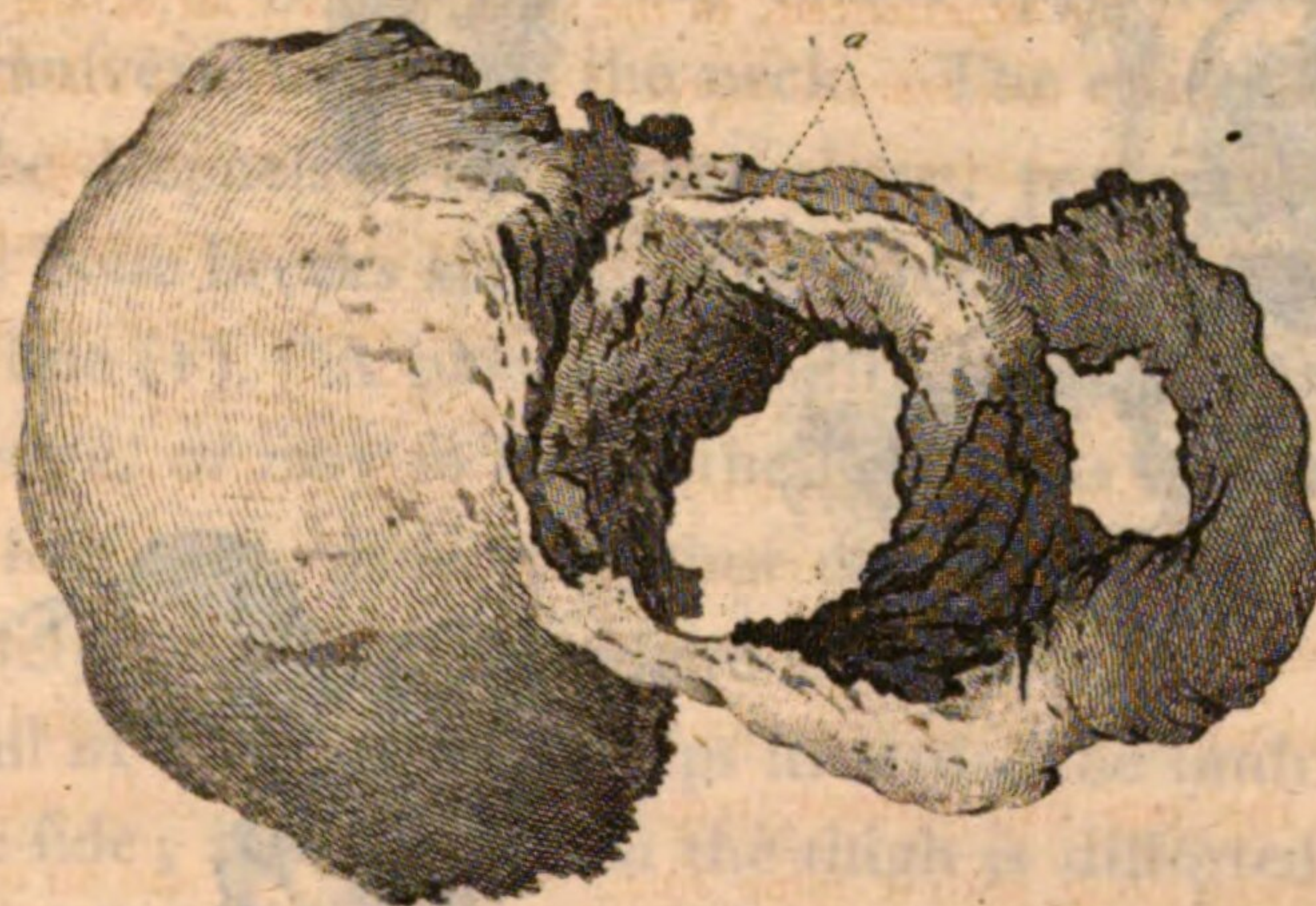
‡ A woman about eight-and-twenty years of age, laden with a basket full of bottles, having jumped down a few stairs in going into a cellar, preserved the centre of gravity of the upper parts upon the left thigh and leg.

CONCLUSION.—This then is a disease which has been known in all ages and in all climates, and authors have from time to time noticed it, but not with that fixed attention which so important a matter deserves. The older authors may have been inaccurate in names, and (what is more to be lamented) careless of those distinctions which are so necessary and useful in practice; but the phenomena of a disease so very remarkable as this could not escape their observation. This is the consecutive or secondary luxation of the French authors; and when the celebrated Sabattier proceeding to describe the consecutive luxation begins thus, "I was consulted for a girl of thirteen years of age;" we are sensible even by this, that he is going to describe a scrophulous disease of the hip joint, and his description confirms the suspicion raised by the tender age of his patient. The celebrated Petit, who was indeed the first who described this disease with accuracy, is in fact employed in writing an elaborate essay on the hip disease without knowing it. In short, the French surgeons, from their loose and vague manner of writing, introduced great confusion into this department of pathology; they first confounded luxation with the bruise of the acetabulum, which

so well, that *she kept herself from falling*; but she experienced, in the inside of the joint of the hip, *a violent shock*, which was, however, attended *only with a very bearable degree of pain*, since she was able to continue her ordinary work for more than a fortnight, *without complaining*. But she still felt, in walking, a pain which *gradually increased*, from the continual exercise she was obliged to use in her capacity of servant: the difficulty of motion increased with the pain; and both the one and the other, *three months after the accident*, were grown so much worse, that the woman was no longer able to support herself upon that limb. At this period she came into the hospital where I attended; different embrocations were used to the upper part of the thigh, but without any effect; resolute, anodyne, and maturing cataplasms were then applied, because a tumor manifested itself at the upper posterior, and external part of the thigh, which seemed tending to suppuration. A fever came on; and when the abscess became evident, all the openings and counter-openings were made, which the sinuses the pus had formed, required; the matter which came out, had no kind of offensive smell: it brought away along with it some small bony particles, and an oleaginous fluid floated on the surface; the incisions were lengthened as much as it was thought necessary, setons were passed, and during the course of the treatment, vulnerary and deterfive injections were tried, such as were imagined to be best suited to the state of the parts. At different intervals small portions of bone came away, separated either from the head of the thigh bone, or from the cavity of the joint, into which several of the sinuses penetrated. A slow fever and a marasmus, which is its usual attendant, destroyed the patient between three and four months after her admission into the hospital. Upon examining the seat of the disease, I found the capsular ligament almost destroyed, the round ligament totally consumed, *the head of the thigh bone carious in all its surface, and even to a considerable depth in its centre; the cavity of the joint was also attacked with caries throughout its whole extent; and lastly, its cartilaginous border was completely destroyed.*

they described as a consecutive luxation ; and they next confounded this bruise of the acetabulum or consecutive luxation with the scrophulous disease of boys. This hip joint disease is the ATROPHIA post ICHOREM et MELICERIAM acrem articularum exulceratorum, of Hildanus, whose description of the consequences of this disease, and of the manner in which the joint becomes ankylosed, is curious and accurate : “ Ichor enim ille, qui ex toto corpore ad articulum vulneratum fluit, primo ligamenta et vincula, quæ articulum cingunt, deinde cartilagines etiam, quibus junctura incrustata est, erodit et absumit. Hinc fit, ut ossa à suis cartilaginibus et vinculis denudata, inter se callum (quod ante me nullus, quod sciam, observavit) tam firmiter coalescant, ac si nunquam ea in parte fuit articulus. Hoc multis paradoxum esse videbitur ; ego vero expertus loquor.” In short, he was the first that observed this disease.

*Destruction produced by the Scrophulous
Disease of the Hip joint*



(a) Acetabulum destroyed



*(b) head of the Thigh bone
destroyed*

Ford

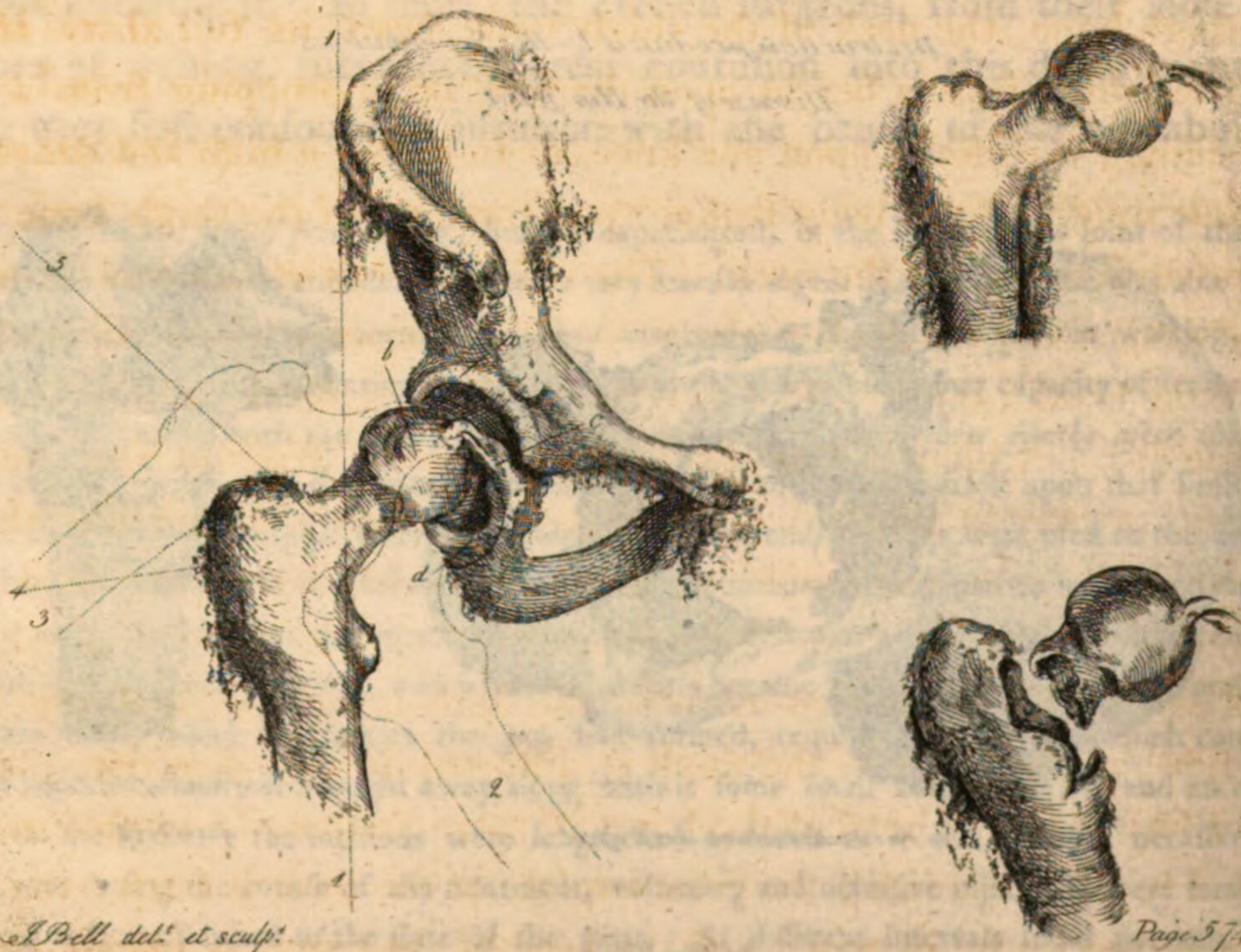
D. Lizars. sculp.

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DIAGNOSIS OF THE VARIOUS ACCIDENTS AND DISEASES OF THE HIP JOINT.

In distinguishing the various affections of the hip joint, we can trust nothing to the opinions of the older surgeons, so entirely unacquainted with the scrophulous disease, and so inaccurate in their distinctions of all the other affections of

the joint ; this I have already hinted, and shall now have occasion to prove. Nor is it indeed by authority and the facts of others that we should be guided in the practice of our profession, but rather by reason, by our knowledge of the structure of the parts, and in the present case, by observing the various distortions and shortenings of the limb ; for it will be found, that from the peculiar structure of the hip joint, certain accidents will produce invariable appearances, and luxation, fracture, or injury of the acetabulum, will give infallible signs of distinction by the peculiar distortions of the limb. I well know how difficult it is to remember correctly the forms of any internal part, and how much more difficult it is to apply such anatomy to the peculiar circumstances of each case ; how impossible it is to reason upon luxations and fractures as abstract subjects, without some sensible representation of the facts ; it is for this reason that I think it advisable to accompany each difficult point of the diagnosis with a simple plan.



The first plan that I lay before you, is such a scheme of the hip joint as will explain decidedly the effects of blows or falls in various directions. (a) Marks the deepest part of the socket which entirely receives the round head of the thigh bone, and upon this point the whole weight of the body rests. (b) Next marks the head of the thigh bone raised and turned a very little out of its acetabulum, in order to show the hollow of the acetabulum and the root of the round ligament. (c) Marks the round ligament which arises rather from the lower mar-

gin of the socket, and which prevents the head from starting out of the socket, or being at all luxated till this ligament is burst; and indeed it would seem as if the weight of the body were in some degree supported by this strong ligament, though the weight is chiefly balanced upon the head of the thigh bone. (d) Marks that deep part of the socket where the mucous ducts and fatty fimbriæ lie, and where the inside lining of the capsule is most peculiarly delicate; and since the body hangs by the upper part of the socket on the top of the thigh bone, this delicate apparatus, lurking in a small dimple at the lower part of the socket, escapes all dangerous pressure, and is but gently moved as the central ligament moves.

With the plan of the joint thus before us, nothing is more easy than to judge, with almost mathematical precision, of the effects of each particular blow or twist. 1st, In the perpendicular posture of the body, when the pelvis rests fairly on the head of the thigh bone, the neck of the thigh bone bears its full share of the weight; and in falling from a height upon the feet, or in dropping from a window †, or in falling with force upon one knee, or in taking a high and dangerous leap, the whole weight of the body strikes upon the head of the thigh bone in a direction transverse to that of the neck. The resistance of the ligament from below, and the deepness of the socket above, prevents luxation upwards, and the neck of the bone breaks across. The direction of such a shock is indicated by the dotted line (1). A blow in this direction, then, may fracture the neck of the thigh bone, or may so bruise the socket, as to produce a disease like that of boys (*vide* foot note, page 572.) but can never hurt the lubricating apparatus, which is safely lodged at (d), where no pressure is.

2d, A fall in which the foot slips inwards, the limb is twisted, and the body falls on one side; in short, when the thigh is distorted in the direction marked by the dotted line (2); the head of the bone is more frequently twisted out of its socket, and luxated upwards; the great capsule of the joint is burst; the central ligament is torn up by its root; and the head of the femur is lodged on the back of the haunch bone, or in the sciatic notch.

† “Voici ce que j’ai vu. Un homme voulant descendre d’une fenestre un peu haute, se glissa le long du mur, le dos tourné du côté de la rue, et se tenant sur le bord de la fenestre avec les mains, lorsqu’il se fut allongé pour approcher, autant qu’il le pouvoit du pavé, et tomber de moins haut, il lâcha ses deux mains, et tomba à terre sur la plante des deux pieds, mais inégalement. Le pied droit porta le premier, et souffrit tout le poids du corps, dont la force étoit multipliée par la vitesse de la chute. Le pied, la jambe et le corps du fémur résisterent, parce que la ligne de direction du poids du corps tomboit perpendiculairement dessus; mais le col du fémur, par la raison contraire, se cassa à cause de son obliquité.”

3d, But when the person slips his foot, so that the inside of the ankle slides along the ground, and that the limb is twisted outwards; or when having a heavy burden on his back, he falls, so that the inside of the knee strikes the ground; or when, as in laying a sack of corn from his back upon a cart, he makes one step away from the cart, and the sack falls upon his extended leg, so as to twist the limb outwards; then the thigh bone comes into the direction denoted by the dotted line (3), the head of the thigh bone is turned downwards towards the lower part of the socket, and is easily luxated in that direction, because there the socket is imperfect, its border is low and guarded only by a ligament (the ligamentum labri cartilaginei), while the central ligament prevents only luxation upwards, because its root arises near this lower border of the acetabulum.

4th, It is very obvious, that when the thigh bone is struck in the direction of the dotted line (4) by a fall upon the trochanter, its head is beaten down into that part of the socket where the mucous ducts lie, and these soft parts are bruised, whence comes immediate and dreadful pain, high inflammation in the joint, and sometimes suppuration and caries of the acetabulum, followed by ankylosis.

5th, When the great trochanter is struck obliquely from above downwards in the direction of the dotted line (5), any of all those accidents may ensue, for the head of the bone is struck so downwards into the socket, that very frequently the mucous ducts are injured; or being struck thus obliquely, the head of the bone may be luxated downwards, by being driven over the border of the acetabulum at its shallowest part; or, finally, by being struck thus obliquely, the neck itself may be broken.

In enumerating these consequences, it is to be observed, that the effect of no particular blow is absolutely limited, while yet it may in general terms be affirmed, that luxation is produced by a twist of the limb; fracture of the neck of the thigh bone by a desperate leap or fall from a height; while falls in which the trochanter strikes the ground, though they do sometimes luxate or fracture the thigh bone, more commonly injure the acetabulum and its lubricating apparatus. It must be matter of wonder, indeed, how, since the soft parts within the socket are so easily injured, they ever escape disease in any of the common accidents of the joint? but it is to be observed, first, That the bone is luxated or fractured by blows or twists, which tend rather to turn the head out of the acetabulum, than to drive it down into the cavity. Secondly, That the mere laceration of an internal part, as of the central ligament, heals very easily; for in every case of lux-

ation it must be torn, and yet no disease ensues. Thirdly, The actual fracture or luxation produces no disease, because that peculiarity of constitution is wanting which produces in boys the most dismal consequences from the slightest accidents, not in this joint only, but in all the joints. And, lastly, We find, that even when, in consequence of inflammation arising from mere local injury, the bones do inflame and throw out callus, it is a healthy inflammation like that of a granulating wound, and stops spontaneously as soon as the callus is formed, and the reunion of the neck of the thigh bone or the formation of the new socket completed.

Till the various accidents of the hip joint be accurately defined, a surgeon cannot know what appearances are to be contrasted (although, to distinguish any one accident of the hip joint, he must know and remember every accident); till the causes be described which occasion those various accidents, he wants the key to the proper inquiries; and, finally, till he has before him some sensible representation of the posture which the limb assumes in each of those accidents, he must argue but very incorrectly! It is for these reasons that I have drawn out for you a second set of plans, in which the whole length of the limb is represented. When the patient has had his limb violently twisted perhaps under a heavy load, we suspect luxation; when he has taken a dangerous leap, and fallen to one side, or when he has fallen upon one knee, and the hip joint is hurt, we suspect fracture of the neck of the bone; when the trochanter has been struck with immediate and violent pain, we suspect rather an injury of the acetabulum. But the actual condition of the limb may be ascertained by the following marks:

1st, The limb being sound, or but slightly hurt, is moveable, but not loose; the joint moves easily and smoothly; you can turn the thigh bone in every direction, though not without a degree of pain proportioned to the injury; and this is principally to be noticed, that the point of the haunch bone, the knee and the great toe, are all in one direct line; or, in other words, the leg, thigh and body, all lie in the natural direction with regard to each other; and the limb being measured with its fellow, is of the same length, and answers knee to knee, ankle to ankle, and toe to toe; for though the patient will naturally distort the leg to give himself ease in the bruised part, yet the surgeon can by a little force make the limbs even. Figure 1st.

2d, When the thigh bone is luxated, the limb is always immoveably fixed by the entireness of the neck of the thigh bone, and the awkward posture in which the head lies against the pelvis; and when the thigh bone is luxated upwards, we have the following decisive marks of its condition: Observe, first, that the capsule is

burst, the central ligament torn across, the middle glutæus muscle in part torn up from its origin in the haunch bone, while the head of the thigh bone is lodged under it, and lies pressed against the back of the haunch bone; the head of the luxated bone looks backwards towards the sciatic notch, and sometimes lies fairly lodged within the sciatic notch, so as to cause a numbness of the limb by its pressure against the sciatic nerve. The effects then are as follows: The whole posture of the limb is not slightly but very unequivocally distorted, the head and neck of the thigh bone are firmly braced down against the back of the pelvis by the surrounding muscles, whence the limb, which lies in a very awkward posture, is absolutely immoveable. The head of the bone having started fairly over its socket, and lying even as high as the sciatic notch, that is, at the distance of three or rather four inches from its natural situation, the limb is very remarkably shortened; for when the thigh bone thus rises four inches, the heel of the luxated limb is opposite, not to the heel of the sound limb, but touches it a little higher than the ankle, and, indeed, in the distorted posture in which the patient lies, the heel of the luxated limb is nearly opposite to the middle of the sound leg. Next the neck of the thigh bone being entire, and the head of the bone looking backwards towards the sciatic notch, the whole limb is singularly distorted, the toe is turned inwards, or rather backwards, and the knee of the luxated limb falls in behind the thigh of the sound one, and in this awkward posture the limb is so immoveably fixed, that when you attempt to turn the thigh bone, you give great pain; in the moment of the attempt, you are sensible of insuperable resistance; indeed, if, you could turn the thigh bone, you would reduce it.

Now, when the limb is thus luxated upwards, if you lay your patient on his belly, you will find the leg half bent, and standing up at right angles with the thigh; and taking the leg in your left hand, and working it like a rudder backwards and forwards, laying your other hand at the same time flat over the haunch, you will be sensible, every time the thigh bone is turned, of the ball or head of it turning under your hand; and when you persist in turning it very largely and rapidly, you will be very sensible of the head and neck of the bone clucking against the haunch bone. But of all the marks, none is more particular than this, that the great trochanter rises very high, the prominence which we call the haunch seems to be transferred very high up upon the hip, the thigh is remarkably shortened and flattened, and when you first begin to roll the thigh bone and to feel the joint, you would be apt to mistake the trochanter for the head of the bone, and

Fig. 3 Luxated upwards explained
page 579



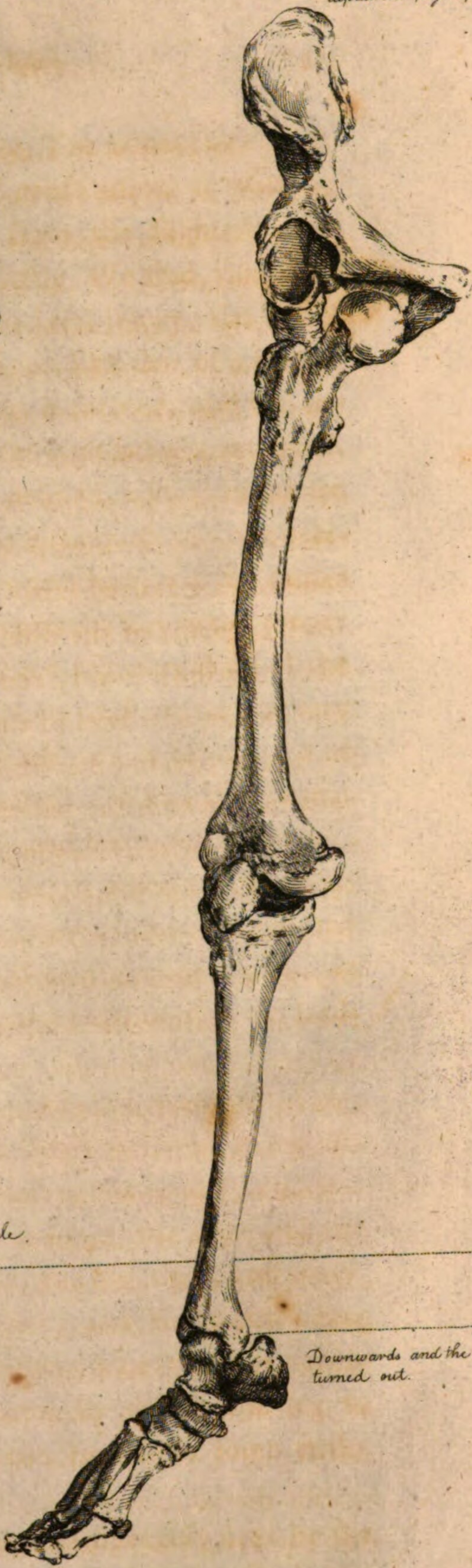
Upwards and the toe
turned in

Fig. 1. Natural — explained page 577



Natural line
of the ankle.

Fig. 2. Luxated downwards explained page 578



Downwards and the toe
turned out.

Sketches for the Diagnosis of Luxations

Drawn & Engraved by J. Bell

the clucking noise of the luxated bone for the grating of a fractured one. Figure 2d.

3d, When the thigh bone is luxated downwards, the burfal and central ligaments are lacerated, the obturator muscle which fills the thyroid hole is in part torn up from its origin, and the head of the bone is lodged in its place; the turning or rotation of the thigh bone is in this luxation also entirely prevented by the awkward posture of the neck; the head of the bone looks forwards, or rather upwards, and the limb is as much fixed as when luxated upwards.

All the peculiarities of the distortion first described are reversed in this luxation; the head of the bone is now lodged in the thyroid hole, a part of the pelvis so much lower than its natural socket, that the leg is lengthened fully three inches. The head of the bone in this luxation looks forwards and upwards, so that the toe which was turned inwards in the luxation last described, is turned outwards in this; and the head being now turned forwards, the knee, which in the upward luxation lies under the sound knee, is in this turned remarkably outwards, while the whole limb is kept in a very remarkable manner straddling away from the body. In the luxation upwards, the head of the bone is less distinctly felt, because the trochanter is apt to be mistaken for it, the head and neck lying deep under the glutæi muscles, whereas in this luxation, the head of the bone is felt rolling very distinctly and superficially in the groin, very nearly in the place of the venereal bubo, for at this point the joint of the hip is not covered with large muscles, such as the Glutæi, but with one thin and flat muscle, the Pectineus, and the joint is so near the surface here, that the suppuration in the hip joint-disease usually bursts first in the groin. Figure 3d.

4th, The peculiar signs of fracture of the neck of the thigh bone are not less decisive. The moment the neck of the thigh bone is broken, the bone is retracted by the power of its muscles, it is turned somewhat round by the rotatory muscles (the Obtur. Internus. quad. Femoris, &c.), operating upon the shaft of the bone; and while the head and neck of the bone remain in the socket, the broken part of the bone at the root of the trochanters mounts upwards. The following signs then must follow those peculiarities in the posture of the bone. First, the moment the neck of the thigh bone is broken, the shaft of the bone is so retracted by the power of its muscles, that you would imagine the bone to be luxated upwards; secondly, observing next the posture of the leg, you find that the toe is not turned inwards, nor the knee of the hurt limb bent in under

that of the sound one, nor is it turned outwards in that fixed, awkward, and straddling posture which indicates luxation downwards. Thirdly, you next begin to turn the limb and to hearken for crepitation; but you will remember that this fracture is distinct from all others, in having no crepitation, for the ends of the broken bone are not opposed to each other (as where a bone is broken across its middle), but the broken neck of the bone remains in the acetabulum, while the part (i. e. the root of the trochanters) where the neck of the bone was broken away from the shaft is so retracted, that the fractured parts are never opposed to each other, unless indeed in the moment of extending the limb with the design of setting the fracture, for then the limb being drawn out nearly to its natural length, the fractured parts come to be opposite to each other, and the crepitation is distinguished †. Fourthly, It is to be observed, that the limb cannot be fixed and embarrassed by the neck of the thigh bone as in luxation; the connexion betwixt the head and shaft of the bone is destroyed; the limb is not only free, but absolutely loose! the natural thigh bone moves easily, but the broken thigh bone turns loosely, as far as a bone can turn loosely which is encumbered with such a mass of muscles lying about it.

This also is very particular, it turns vertically like a spindle. If you take in your hand a sound limb with the design of turning it, and lay the palm of your hand over the trochanter, you will be sensible that the bone moves slowly and steadily, because it is connected with its neck. The head of the bone is the centre of motion,

† It is a very favourable instance of the candour and honesty of Paræus, that he begins this subject with acknowledging a very singular mistake: He had been called to a lady who, after a fall, had the limb so shortened and the toe so turned in, that he believed it a luxation, reduced it (as he imagined) and applied but a slight bandage, not apprehending that the limb would be shortened again. But two days after, upon visiting her, he found the limb as short as before, and it was only upon extending it a second time that he felt the crepitation or understood the limb to be fractured. It is, perhaps, worth while to observe, that the crepitation, when it is felt, is not like that of any other broken bone, it is an obtuse grating, more like the feeling which the staff gives when it rubs against a stone. “*Quelquesfois il se fait fracture pres la jointure de la hanche au col de l'os femoris: ce que ie proteste avoir veu en une honneste Dame, ayant esté appellé pour la penser. Voyant que sa jambe estoit plus courte que l'autre: avec une eminence que le trochanter faisoit exterieurement au dessus de la jointe de l'ischion; i'estimois de prime face, que ce fust la teste de l'os, et y avoit luxation, et non fracture. Alors je tiray et poussay l'os ce me sembloit en sa boîte, attendu que les deux jambes estoient égales en longueur et figure: et la pensay et accoustray comme d'une luxation. Deux jours apres ie la sus revoir, qui se plaignoit sentir une extreme douleur, et trouvay sa jambe courte, et son pied tourné au dedans. Alors je defis toutes les bandes, et trouvay l'eminence comme auparavant. Adonc ie m'efforçay derechef à reduire l'os en sa boîte. Cependant i'apperceu que l'os crepitoit.*” PAREE, p. 343.

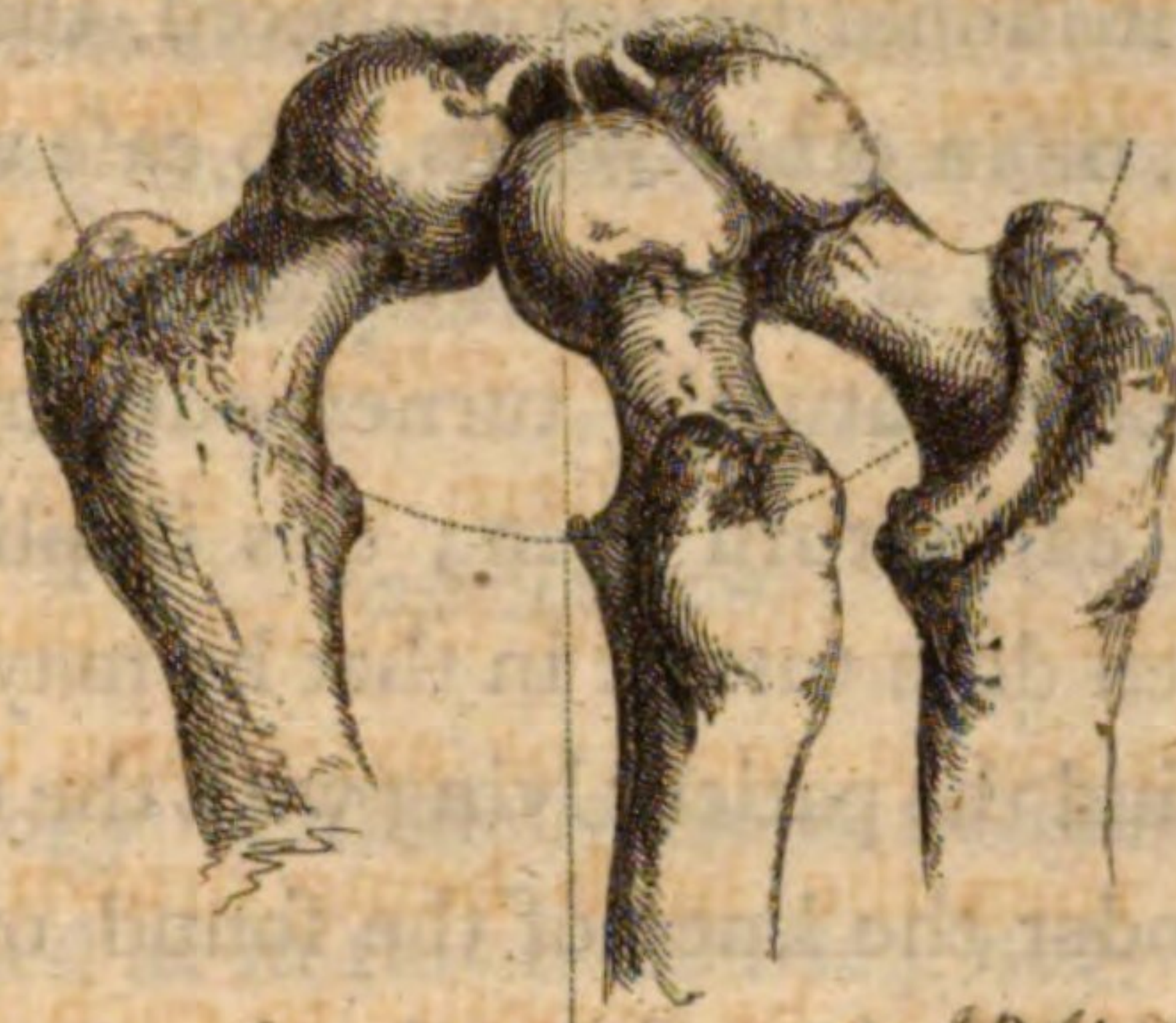
the trochanter is at the distance of three inches from that centre, and moves in large circles, of which the bone is the radius; broken away from of the bone is itself the trochanter of cally in its place with- cle, it merely turns

The fracture of the then is easily distin- tion, by the ease with turned, by the thigh

cally upon its axis, by the leg being much shortened, easily lengthened by extending it, but very difficultly retained. But though I affirm that the thigh bone is easily turned and moved in various directions, I mean so only in reference to the mechanical resistance, for it is not moved without dreadful pain! the ragged trochanters and broken part of the bone are lodged among the soft parts, and every time you try to draw the leg outwards, the patient suffers dreadful pain from the pressure of the broken part of the femur against the lacerated parts which lie on the back of the haunch bone; thence it is, that the patient is no sooner laid in bed than he inclines the knee inwards, and distorts the limb in order to raise the broken end of the bone and prevent it pressing against the lacerated flesh.

This last observation reminds me of the necessity of explaining two doubtful points in the diagnosis; first, it is not certain that the toe is always turned outwards; secondly, it is not certain that the limb is always immediately shortened.— You may have observed (*vide* foot note, page 580.) that Paræus describes the toe as turned inwards, “*La jambe court et son pied tourné en dedans.*” Petit also, in his *Maladies des Os*, mentions, that being called to a patient under the care of a surgeon who had not read Paræus, and who mistook the nature of the injury, “he found, upon undoing the bandages, the great trochanter four inches higher than its natural situation, and the toe and the knee turned inwards †.” Now, although Mr. Petit is here plainly narrating a case, and reporting a very certain fact,

† “*L'appareil étant défait, je sentis le grand trochanter quatre doigts plus haut qu'il ne devoit être, ce qui, joint à ce que la pointe du pied et le genou étoient tournés en dedans, me fit croire que l'os étoit luxé en haut et en dehors; mais, ayant pris le pied, j'en tournai la pointe en dehors sans résistance, et je reconnus par là qu'il y avoit fracture au col du fémur.*”



Page 581-

J. Bell Sculp.

neck of the thigh but when the shaft is the neck, the shaft the centre of motion, course turns vertically making any circle like an axis.

neck of the bone guished from luxa- which the limb is bone turning verti-

he is accused of merely copying what is considered as a blunder of Paræus ! and the most celebrated surgeons, as Louis Sabattier and others, plainly affirm that the toe cannot be turned in. But it should be remembered, that the ease with which the thigh bone turns vertically, or in other words, the ease with which we turn the toe outwards or inwards at pleasure, is among the most decisive marks of this kind of fracture ; that though the toe is naturally turned outwards by the action of the rotatory muscles, yet we can easily turn it in ; this implies that the patient himself can turn it in ! He often does turn it in that he may lie with greater ease ! and accordingly you will often find the patient lying with the toe turned in, and the knee of the hurt limb turned under the knee of the sound one, for in this posture the fractured part of the bone is lifted up from the lacerated flesh. In short, there are two postures of the limb, first, That which it takes while the parts are insensible immediately after the accident ; secondly, That which it is instinctively put into for ease after the patient is laid in bed. But though the posture of the limb comes thus to be nearly that of a luxated thigh, viz. the limb shortened, the toe turned in, the one knee falling under the other, yet still fracture is easily distinguished from luxation by the mobility of the limb.

Secondly, There is one point more in which there is a degree of uncertainty, for the most decisive symptom of all is sometimes wanting, I mean the shortening of the limb : The shortening of the limb in fracture of the neck of the thigh bone, is not, as in luxation, the unavoidable effect of the posture of the bone ; it is an accidental consequence of the contraction of the muscles, and sometimes these are so benumbed by the injury, or so inactive from some other cause, that they do not pull up the thigh bone. Even though we were less able to explain the fact, we are not less constrained to receive it, it stands upon record. Sabattier has, in consultation with Louis, Foubert, and Gourfoud, seen on several occasions the neck of the thigh bone broken, the limb remaining of its usual length, and the retraction happening suddenly, from the patient being turned rather rudely in bed by the helper of the hospital. Sometimes this retraction has taken place on the fourth or fifth, sometimes not till the twenty-third day after the accident.

Yet here there must be a deception, when Sabattier tells us of a boy of fifteen years of age who, after receiving a blow upon the trochanter, walks home, feels pain next morning, lies two months in bed, and after that has a shortening of the thigh † ;

† Un jeune garçon de quinze ans se laissa tomber entre deux pieces de charpente sur lesquelles il marchoit il sentit une légère douleur à la cuisse gauche qui ne l'empêcha pas de regagner à pied et sans boiter sa maison, distante d'environ deux portées de fusil. p. 638.

and more especially, when he tells of another who continued to walk about for two months after the accident ‡, what are we to understand but that it is very possible to confound the injury and caries of the acetabulum, with the fracture of the neck of the bone? this but confirms the remark I hazarded in opening this subject of the diagnosis, that we can trust none of the facts that are affirmed even by the best modern writers on this subject.

CONCLUSION.

A slight and easy pathology of these various accidents, and an accurate diagnosis, is all that I have aimed at in this discourse; nor do I know of any subject in surgery which so well merits a careful recapitulation. The disorders which need to be distinguished from each other are, fracture, luxation, bruise of the acetabulum, and the scrophulous disease of boys, seated unquestionably in the bones; and the chief signs are, the length of the limb, the direction of the toe, the place of the trochanter, the elongation or shortening of the limb, and the manner in which it turns when moved by the surgeon.

First, We are assured that the thigh bone is luxated downwards, when the accident has been a twist of the limb, or a blow upon the very top of the great trochanter; when the thigh is elongated three inches or more; the toe turned outwards, in a splay-foot posture, and kept straddling away from the body with great pain. This luxation is accompanied with a proportioned displacement of the great trochanter; the hip is flattened, and in lean people you can distinguish the head of the bone rolling in the groin, though not in fat subjects, nor in women whose pelvis is broad and flat.

Secondly, We distinguish luxation upwards by the remarkable shortening of the

‡ J'ai vu aussi un cas de cette espece et même beaucoup plus extraordinaire en ce que le malade a continué de marcher un mois après l'accident qui lui avoit rompu le col du femur. p. 639.

It is also very remarkable, that Mr. Sabattier says, that in cases where there is no retraction, "The extreme pain and absolute lameness are the only signs, and are sure signs of the fracture." Yet certainly where there were no retraction, or in other terms where the broken pieces of the bone were rightly opposed to each other, crepitation must have been as natural, inseparable a sign of this fracture as of any other, especially when his patient walked about for days and weeks. But this is idle criticism; there never was a case in which a man walked about with a fracture, even in the middle of the thigh, where the bones are regularly opposed to one another, much less in a fracture of the neck, where though the bones may touch each other laterally, they never can be opposed to each other, nor support the weight of the body.

limb, by the ham being crooked, the knee of the luxated side turned close in under the thigh of the sound side, and the toe turned inwards or almost backwards. The great trochanter rises very high, and the thigh is flattened in this case as much as the hip is in the last mentioned. The patient lies on his sound side almost on his face, and when you take hold on the leg which stands up, and begin to turn it, you, by laying your hand over the most tumid part of the haunch, feel first (because it is the most prominent point) the rolling of the trochanter, and then by carefully examining and turning the thigh bone, you at last distinguish the head of the bone.

Thirdly, When the neck of the thigh bone is fractured, the limb is remarkably shortened, the trochanter is higher than its natural place, the thigh is flattened, the pain is exquisite, and the general appearance is that of a thigh bone luxated upwards! but the moment you take the limb in your hand, you distinguish this from all other accidents; for while the limb is so remarkably shortened as to leave no doubt of some very essential injury having happened, it yet turns so easily as to prove that it is not luxated, and indeed it turns so loosely as to prove that the limb has not that degree of steadiness which the natural connexion of the shaft of the thigh bone with its head and neck should give. The limb is shortened, but is easily lengthened; the toe is turned out, but is easily turned in again; in short, the manner in which it moves will satisfy you at once that the shaft is separated from the head of the bone. If crepitation be not among the immediate signs of this fracture, it is because the bones are not, as in other fractures, opposed to each other; if crepitation be felt afterwards, it is only when the limb is extended, and the bone set, or in other terms the broken parts regularly opposed to each other.

Fourthly, When the patient has fallen upon the trochanter or received a blow, when the head of the bone has been struck down into the socket with violent pain, when the patient becomes instantly lame, and lies in a crooked posture, with the knee of the injured limb bent in under that of the sound, (in order to raise up the head as much as possible from the inflamed socket where its pressure occasions pain,) when, along with these appearances, we are perfectly sensible that the limb, though crooked, is not shortened, when we find, that though when moving it occasions dreadful pain, yet it does move easily and steadily, we may be assured that the fall has occasioned merely a bruise in the acetabulum. In this case the patient lies crooked in bed, the pain is exquisite, the patient cannot bear to have the joint touched, or the limb moved, the slightest motion is terrible to him, to stretch out

the limb is excruciating. The surgeon has not leave to handle the limb freely, or is prevented by his own timidity, and by the shrieks of the patient; he mistakes the nature of the injury, makes cruel attempts to reduce a bone which is neither fractured nor luxated, and does essential injury to a joint already much injured; perhaps he never doubts of the limb being luxated or fractured, till, after some months of the severest misery, the pain remits, the patient begins to walk, and recovers at last the use of his limb.

This mere bruise of the acetabulum is unquestionably the disease which Petit describes, where he says that he has often prevented it coming to any height by applying astringent solutions, and defensives made of alum, and whites of eggs, with spirits of wine. Rest is of chief service, but rest need hardly be recommended to one in such exquisite torture, whose pains are aggravated by the slightest motion.

Fifthly, When a scrophulous boy under eighteen years of age has laboured for long under a disease of this joint, where there is great lameness, little pain, a puffy swelling, an elongation of the limb! if there come at last acute pain, hectic fever, symptoms of internal suppuration, and at last an abscess upon the hip or groin, you know that it is the constitutional disease, that it is seated in the bones, that it is analogous to the white swelling of the knee, or curvature of the spine; but unlike the disease of the knee joint, this of the hip cannot be amputated, and the boy must go through the fiery ordeal, and often dies from fever and irritation, great profusion of matter, and caries of the bones. If he survive, it is usually with a limb emaciated, crooked, hanging in air, and fixed by the ankylosis of the femur with the haunch bone. The chief cause of such disease is the scrophulous condition of the system, the imperfect ossification of the bones, the great extent of diseased surface, and from the occasional shocks which this great joint suffers, in consequence of its supporting continually the whole weight of the body. The chief danger of the disease is the boy feeling but too little pain to make himself or his parents sensible of the danger; if it be not chiefly in consequence of the pressure and motion that such disease goes on to the last stage of caries, yet certain it is, that under the pressure of the whole weight of the body such a disease cannot be cured; the only chance, then, of recovery, is from wine, generous diet, cold bathing, caustics, issues, and absolute rest.



DISCOURSE XIV.

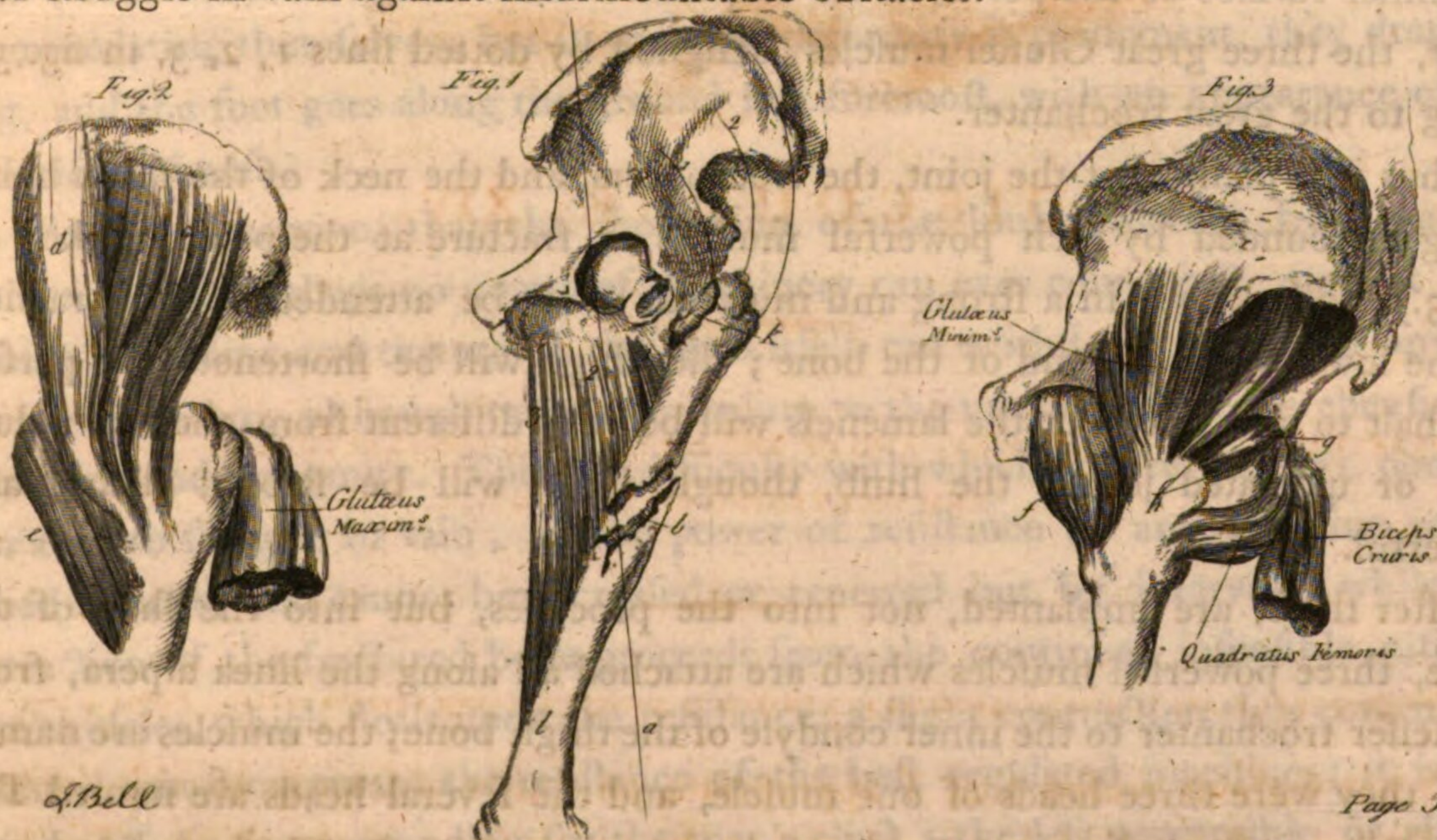
OF FRACTURE OF THE THIGH BONE, AND OF THE IRRESISTIBLE CONTRACTIONS OF THE MUSCLES
AND SHORTENING OF THE LIMB.

NUNQUAM OS EA PARTE VINCIENDO GLUTINARI ET MEMBRUM IN ANTIQUM STATUM REVERTI POTEST. *Platner, § 1272.*

It is not without reason that I appropriate an entire discourse to this subject, the fracture of the thigh bone, or rather the contraction of the thigh. The subject is itself a study, a most interesting study: this is of all fractures the most difficult of cure; the machine is not yet invented by which a fractured thigh bone can be perfectly secured. The natural obliquity of the thigh bone in relation to

the pelvis is such, that all its fractures, even in its middle part, are naturally oblique, and those thick and fleshy muscles which surround the thigh bone at its upper part, and give the thigh its conical form, contract with such irresistible force, that when the thigh bone is broken across at its neck, or at the root of the trochanters, no power of machinery (the resistance of the bone itself being wanting) can prevent the shortening of the limb.

Perhaps there is nothing in the profession that has more agitated the minds of surgeons in all ages, than the expectation of discovering some machine capable of restraining the contractions of a fractured thigh. The machines, bandages, and other inventions, for preserving the thigh extended, are indeed innumerable; but the principles of these inventions are incorrect, the machines themselves are awkward and torturing to the patient; perhaps the natural causes of the contractions are too powerful to be antagonized by any force of machinery, by any force at least which the natural structure of the limb, or the courage and constancy of any patient, can endure. Let us then, before we enter upon the history of those inventions, consider the natural causes of this retraction of the fractured bone, that we may not despair of achieving a cure where the fracture is curable, nor struggle in vain against insurmountable obstacles.



In these plans you will observe, first, The obliquity of the thigh bone with regard to the pelvis, for the pelvis is wide, and separates the thigh bones above, but at their lower ends the thigh bones approach, and at the knees they touch

each other. In consequence of this obliquity, the thigh bone generally receives the force which fractures it in the direction of the dotted line (a), which gives almost always the oblique form (b) to the fracture. Next, you will observe that I here demonstrate powerful muscles which have been already mentioned, as causing the retraction of the thigh. These muscles arise from the pelvis, and are implanted into the thigh bone at its trochanters, to perform in a particular manner the rotatory motions of the thigh. They are of very great size, proportioned to the whole weight of the body, for they have to move the whole weight of the body by bending it forwards upon the thigh bone at every step. They are all placed about the top of the thigh, which gives the thigh its pyramidal form. They are eleven in number; first, the Iliacus, Internus, and Psoas (figure 2. c d) coming down from within the abdomen to be implanted into the lesser trochanter; next, the Pectinalis (e) coming from the pecten or pubis to be inserted in the linea aspera at the root of that trochanter; next, the Obturator Internus (f, fig. 3.) coming from the thyroid hole, or rather from the obturator ligament, to be implanted into the same point, the inner trochanter; next, the Obturator Internus (g), the Gemini (h), and the Piriformis (i), coming from the back parts and inner surface of the pelvis to be implanted into the great trochanter; and lastly, the three great Glutæi muscles (designed by dotted lines 1, 2, 3, in fig. 3.) going to the great trochanter.

Thus it is plain, that the joint, the trochanters, and the neck of the thigh bone, being surrounded by such powerful muscles, a fracture at the point marked (k fig. 3.), will always, in a strong and muscular man, be attended with retraction of the lower fractured end of the bone; the thigh will be shortened, the person will halt to that side, but the lameness will be very different from that of a luxated or ulcerated joint; the limb, though short, will be strong, fleshy, and powerful.

After these, are implanted, not into the processes, but into the shaft of the bone, three powerful muscles which are attached all along the linea aspera, from the lesser trochanter to the inner condyle of the thigh bone; the muscles are named as if they were three heads of one muscle, and the several heads are named Triiceps, Primus, Secundus, and Tertius (triceps 1, 2, 3, fig. 1.). These muscles complete the conical form of the thigh, they draw the knees close together, they cooperate in shortening and distorting the limb when the fracture is at (k), and even when the fracture is at (b), especially if it be oblique, the contraction of

these muscles turn out one end of the bone and shorten the whole thigh ; but when the fracture is any point (as at l) below the chief insertions of the triceps, there is not either in man or boy any shortening of the limb, both because there are no muscles to distort it, and because the rectus cruris and other muscles moving the leg, arise fleshy from the thigh bone, and by the hold they have upon the shaft of the bone all round, they rather tend to support and steady the fractured part. There is no distortion unless the thigh be uncommonly oblique, or unless the thigh be convulsed, the patient delirious or maniacal, or much of the bone be crushed to pieces and destroyed.

But there is a kind of deformity peculiarly frequent in this very case, where there should be none. The fracture is near the leg, the leg is heavy, and the weight of the leg is allowed to turn the thigh bone vertically, the heel sinks, the toe turns out, the thigh bone (the lower end of it I mean) turns a little upon its axis, the slightest turning of the thigh bone gives a remarkable inclination of the foot, and the leg being permitted to lie thus a little turned round during the cure, the patient when he rises is found to walk as if he were splay-footed. In boys I have seen this deformity lessen by degrees, till it was no longer perceived, the shape of the thigh bone, and the turns of its muscles, gradually accommodating themselves ; but in men the deformity is permanent, they drag the leg, and the foot goes along the ground side foremost, with an appearance of paralytic weakness.

We thus perceive, that the shortening of the limb proceeds from natural causes, which perhaps no power of machinery can ever counteract, none at least which the frame and texture of the limb itself can withstand, or which any patient can endure, although excited to endure to the utmost by the apprehension of lameness and deformity. This is a difficulty with which we are, perhaps, doomed for ever to struggle in vain ; for the power of resistance in any machine is applied at once, and cannot be increased or renewed but by intervals ! while the retraction of the fractured bone proceeds from the continual insensible rufus of the muscles, which steals upon the resistance ; a slight contraction thus continually exerted, must overcome the resistance of the best regulated machines ; it is the wind and the sun contending for the man's cloak ; the less perceptible or violent this muscular contraction, it seems to be but the more irresistible.

Whatever has been contrived for preserving a fractured thigh from this contraction, it is my duty to explain. I have indeed but a poor opinion of those

engines with which patients have been tortured, but I cannot withhold from you the knowledge of whatever has been invented by old or modern surgeons; it is fit that you know how anxious all the most sensible men of our profession have been concerning this contraction of the thigh, what means they have proposed for the prevention of it, how the common machines are applied, and how they may be improved. But while it is my duty to explain those machines, it is my privilege to tell you how little useful I myself have found them.

I shall begin this history from the beginning, for Hildanus was the first, at least among modern surgeons, who invented a machine for restraining the contractions of a broken thigh. However much we may be delighted with the appearance of ingenuity, or buoyed up with sanguine expectations from curious and complicated machines, yet we in the end return to the most simple contrivances, and I have no hesitation in giving that title to the machine of Hildanus; it seems indeed so simple that we should be apt to neglect it, but it is in truth the original of all after inventions, and though others may appear more ingenious, I protest that this is the most useful.

"A little girl of eight years of age having fallen from the first floor upon the pavement, had her left thigh bone broken, and being immediately called," says Hildanus, "I found a fracture of the thigh bone just below the lesser trochanter, with a remarkable projection or elbowing of the end of the fractured bone, and a no less remarkable shortening of the limb; but I easily reduced the bone, I bandaged up the limb with splints and compresses, renewing the bandage every third day. Until the fourteenth day, every thing went on prosperously without pain, fever, or any distressing symptom, but on the night of the fourteenth, the little girl, being restless from the heat of the weather, and tormented with the flies and fleas, moved so continually with her body and thigh, that during the twenty-four hours her limb was remarkably shortened, and the elbowing or projection of the bone appeared again. You may imagine (says Hildanus) what woful deformity must have ensued, had I not been furthered by God's good grace †."

† "Puella octo circiter annorum, filia Magistri Abraham Meyeri, Civis Bernensis, cum 28. Mensis Junii, Anno millesimo sexcentesimo vigesimo tertio, ex suprema contignatione domus in pavementum cecidisset, os femoris sinistri in altiori parte fregit. Ego eadem hora accersitus, fracturam completam circa processum minorem vel inferiorem, à Vesal. ossium tabulâ primâ V. notatum, cum insigni extuberantia ossis fracti, versus externam partem femoris inveni; crus quoque longe brevius erat altero."—"Cæterum os confractum feliciter reposui, et applicatis medicamentis convenientibus et spleniis, crus in capsulam ita adaptavi;

The inspiration which Hildanus piously acknowledges, was the invention of that very simple machine which is drawn at the head of this chapter; it was a large case hollowed to receive the thigh and keep it steady; it was made of tin, bend leather, or buffalo's hide, lined and padded with flannels, so as to lodge the thigh pleasantly as well as safely; and it was buckled round the pelvis, knee, and upper part of the leg, with large circulars or straps; in this case or trough of Hildanus, the limb lies in a posture quite natural, easy and relaxed, it lies open, so that we can at all times be sensible of any accidental shortening or retraction of the thigh, it lies sidelong firm and solid, so as even by its weight to preserve its extension, and it is easy at any time to renew the extension by stretching the limb out gently with our hands; and to retain it with a moderate, and not unpleasant degree of firmness, by buckling the straps anew. This is the plain and simple machine which surgeons have forsaken for a succession of ingenious follies.

Yet, for many years, surgeons imagined nothing but the most simple and modest contrivances for securing a fractured limb; nor were there to be seen fifty years ago, any of those rods, screws, knobs, and buckles, with which machines of modern invention are encumbered. The method which I am now going to describe, was long the favourite manner of setting a fractured thigh. I shall describe this apparatus for distinction's sake, under the title of the LONG SPLINT of Duverney, not because it was peculiar to him, since it was used by his contemporaries and by older surgeons, but because he used it of that uncommon length, that it was almost a stilt rather than a splint, extending not merely along the fractured limb, but along the whole body: It was a stiff splint made of thin board or of bend leather, it was laid along the body, reaching almost from the arm-pit to some distance beyond the extremity of the heel. The patient was in a manner laid upon the splint, which was fixed by a succession of circular bands, furrounding the pelvis, leg, and thigh, one or more turns of a bandage went

ut in decimum quartum usque diem omnia nobis ex voto succederent, et a dolore omnibusque symptomatibus immunis ægra esset; interim tamen fracturam de tertio in tertium diem, pro more curavi. Sed quid fit? Cum quadam nocte muscæ et pulices præter modum vexarent puellam, et proinde corpus et crus commoveret, ut spacio viginti quatuor horarum mirum in modum extuberaret, et crus longe brevius evaderet altero, uti ex figura, quam postea addam, videbis. Vides qualis deformitas et claudicatio sequuta fuisset? nisi Deus suâ gratiâ mihi adfuitisset."

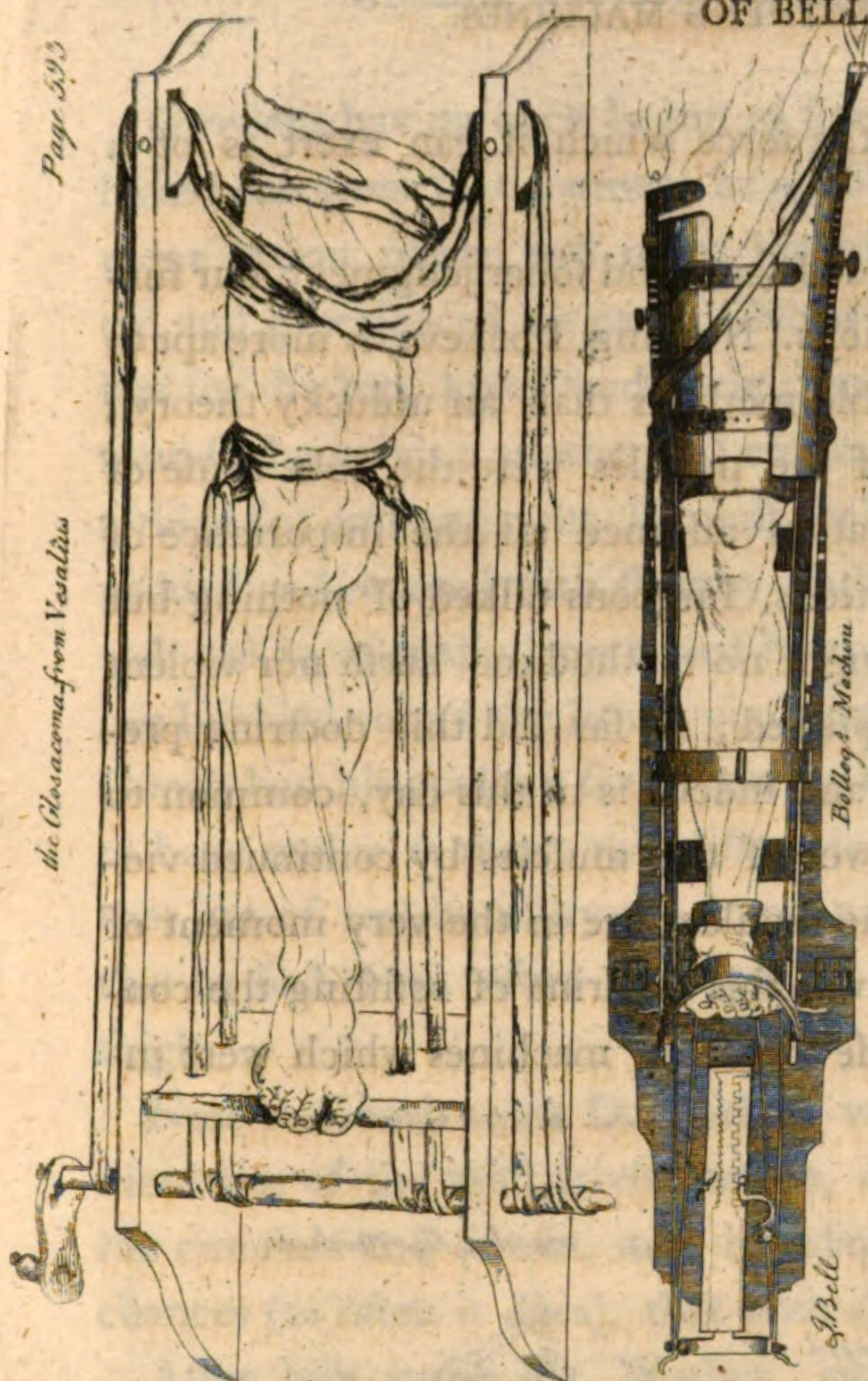
The figure Hildanus mentions here is that which I have drawn at the top of this chapter.

like the tail of a T bandage round the fork under the hip, to secure the hold upon the pelvis ; while on the outside again, the top of the long splint was let into a bandage or folded towel, which was passed round the thorax. Thus was the splint fixed and prevented from flipping upwards, while the limb was kept extended by the circulars furrounding the knee and ankle ; and though sometimes there was laid opposite to this, a short splint upon the inside of the thigh, yet that seems to have proceeded from the unwillingness of surgeons to forsake old and approved methods all at once, for it was from the long splint only that they could expect to steady the thigh.

This is a method which should not be suddenly forgotten. The long splint has indeed the disadvantage of keeping the whole limb in an extended posture, but then it makes the whole limb one piece as it were with the body, it prevents rolling of the thigh bone, secures in some degree the extended state of the limb, and enables the patient to be turned or moved on every necessary occasion without danger of displacing the fracture ; it has been still the resource of the surgeon in his disappointments and difficulties ; and Mr. Desault among others, though he boasts much of his own peculiar method of fixing the body towards the head, and extending the limb towards the foot of the bed by lacs or bandages, seldom neglected to use, at the same time, the long splint of Duverney, to which, no doubt, was owing much of his success.

I am now to deliver the history, not of improvements, but of deviations from the simplicity of those machines of Duverney and Hildanus, of engines so complicated, that it is difficult to describe, impossible to use them, which would carry off the palm from the most curious engines of the Inquisition, which indeed never did exist, except on paper, or in those chambers of the Royal Academy in France, where models of ships, and mills, and ploughs, and fracture-boxes, were tumbled together.

There have been, both in other countries and in England, surgeons delighting in the same trifling ingenuity, who, forsaking the rules of common practice, and the soundest principles of surgery, have been proud rather of demonstrating what machinery could do, than in reflecting wisely on what the living body could bear. Perhaps there never was a more tremendous exertion of this kind of talent, than the machine of Mr. Belloq. which has been for half a century praised by all the surgeons of France, though used, I dare say, by none.



The machine of Mr. Belloq. member of the Academy of Surgery in France, consists of two parts, one which is steady, and has connected with it a sort of case in which the thigh is firmly enclosed; the other, which is moveable, runs in grooves, and is elongated by a vice or windlafs; with this moveable part the leg, foot, and ancle are connected; the thigh is close laced in the case as if in boddice, while the knee, the ancle and the foot, are bound very firm by braces or leather circulars, and when all the apparatus is fixed, the turning of the key or windlafs extends the limb.

By this cruel and complicated engine the limb is kept in air; I do not mean that it is kept in that perpendicular posture in which it is necessarily drawn, but that the whole limb, instead of being re-

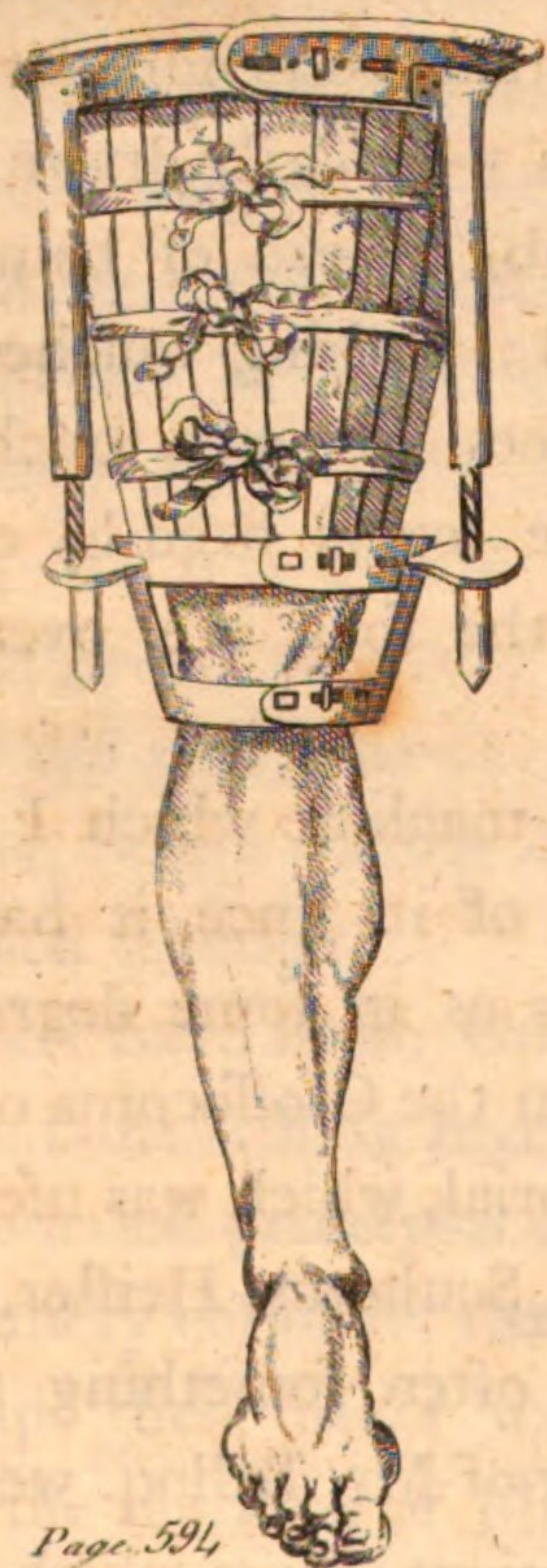
gularly supported, as when lodged in a case, is insulated; nothing touches the limb but the several straps with which it is fastened; it does not even touch the iron rods by which it is kept extended as on a rack; the leg is fixed by circulars at the knee, at the calf of the leg, at the ancle, at the foot, i. e. over the tarsus or place where the buckle is usually placed.

But why should I explain thus in detail the faults of a machine which I have given a drawing of, or argue concerning the principles of it, since it has not even the merit of originality, which oftentimes reconciles us in some degree to things otherwise absurd? this is but a sorry improvement on the Glossocoma of the ancients, a machine which has been known time immemorial, which was used by Galen, and has been drawn in modern times by Vesalius, Scultetus, Heister, and others. In the drawings of surgical inventions, we have often something seducingly simple and artful, but in this complicated machinery of Mr. Belloq. we perceive a cruelty and indifference to the sufferings of the patient, from which feeling and reason equally revolt; it is plainly copied from the glossocome which I

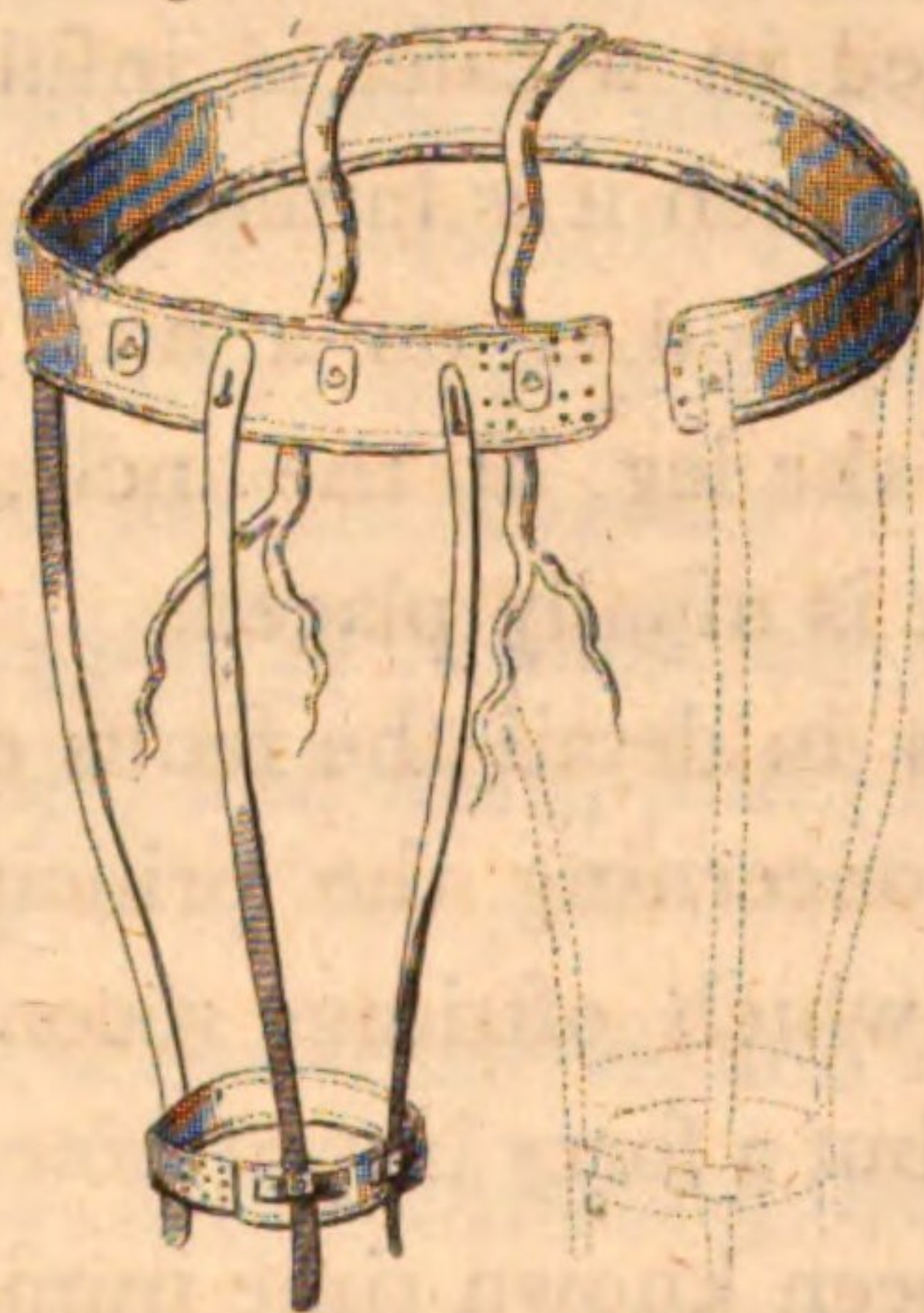
have drawn along with it fide by fide, and the force which it can exert is of a kind which no patient could endure.

To the shame of England, so famed for good sense and sober judgment, our surgeons also have gone in search of new inventions. Nothing, I believe, is more apt to estrange medical men from simple and sensible methods than an unlucky theory; no sooner was it observed that the spasms of the muscles were the sole cause of the retraction of the thigh, than the observation assumed all the importance of a theory, became the rule of all new inventions, surgeons talked of nothing but resisting the power of the muscles, and thought no method too harsh nor violent by which this great object could be accomplished; so far did this doctrine prevail, that in speaking of luxations, it was, and indeed is to this day, common to think of nothing but wearying out the power of the muscles by continued violence, though really the chief muscles of the shoulder are in the very moment of the luxation torn away from the bones! It was this doctrine of resisting the contraction of the muscles that gave rise to those torturing machines which were invented by Gooch, Aitkin, and Wathen.

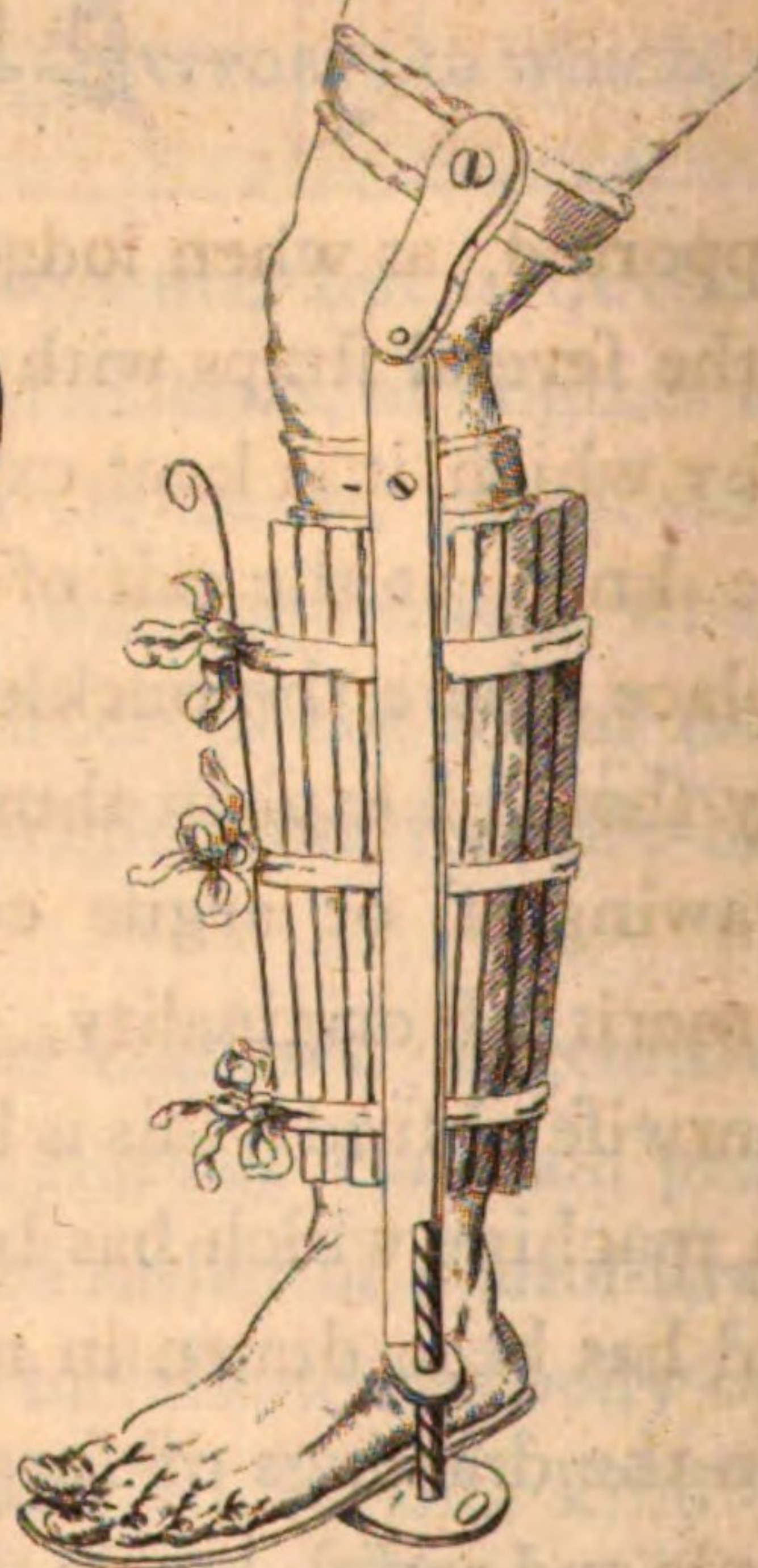
Mr. Benjamin Bell



*Aitkin's improvement of
Gooch's Machine*



Gooch's leg Machine



J. Bell

These are three several drawings of Mr. Gooch's machine. Figure 1st, shows his machine as improved by Dr. Aitkin, where are seen the rods, the girths which pass under the perineum, and the circulars for the

Surgeons having once begun to screw the limb into an extended state, seem to have been from that moment incapable of imagining any other kind of improvement except newer and more ingenious screws. The machine of Gooch, an old and experienced surgeon of Norwich, consists, like that of Belloq. of circulars for the hip, knee, and ankle; one large and well padded circular (a) surrounds the pelvis; another (b) embraces the thigh just above the knee joint, and a third (c) embraces the leg just below the knee. Those three circulars, well padded and covered with shamoy leather, are connected by iron rods (d d), the rods are occasionally lengthened by turning the screws (e e), and the circulars being buckled round the limb, you turn the screws in order to extend the limb. Gooch had his apology for inventing this machine; he was too old in practice not to have met with many real disappointments, and he openly acknowledges (whether out of real humility we know not, or to give importance to his discovery), that he had been often and cruelly disappointed in trying to cure a fractured thigh.

Next to Gooch came Dr. Aitkin, whose machine is the same, whose improvement was of the most trivial nature, consisting in some unimportant changes in the circulars and screws, and in adapting the machine to both thighs, when it chances (as often it does), that both thigh bones are fractured at once.

After him came Mr. Wathen, who, anxious to save patients from the real injuries and dangers of being carried awkwardly by unskilful attendants, invented a machine which he proposes should be applied immediately to a broken limb, and which from its preserving the limb while the patient is carried home he calls a Conductor. It is manifest that Wathen's conductor differs in no respect from the machines of Gooch and Dr. Aitkin; it consists, like them, of well padded circulars which buckle round the knee and ankle; the circulars are connected with iron rods which steady the limb, and the notches and checks on those iron rods secure the extended posture of the limb, and being applied above

pelvis and knee. Figure 2d, shows the same machine adapted to the leg; and in this second drawing, the lower circular which surrounds the lower part of the knee joint is seen in outline. Figure 3d, is a figure from Mr. Benjamin Bell's book, in which his way of applying these machines is represented, and from which, I believe, the reader will form a pretty correct judgment of their effects. N. B. Both in the leg and in the thigh, both in Gooch's and Mr. Bell's drawings, are seen those old fashioned splints, &c. which surgeons have forsaken so unwillingly, and which were always applied under those machines.



the stocking and breeches when the leg is broken, it enables the attendants to carry the limb safely, and serves as a conductor, and after the limb is properly bandaged and set, it may remain about the limb as a fracture machine. But, like the machines of Belloq. Gooch, and Aitkin, it grasps the limb only at distant points, as if with coarse unfeeling hands, it supports the broken bones at their extremities only, while the general limb is left unsupported and in air; like other machines, it has been praised out of all measure by its inventor, and neglected by every other surgeon; like the other complex machines, it has been forgotten and neglected in favour of the simple splint, or the still more unaffected practice of laying out the limb upon a pillow. This like other inventions of the kind, is explained to us by a drawing very nice and clean, but which, in place of being true, is a mere fiction; in place of reminding us of a fractured limb all

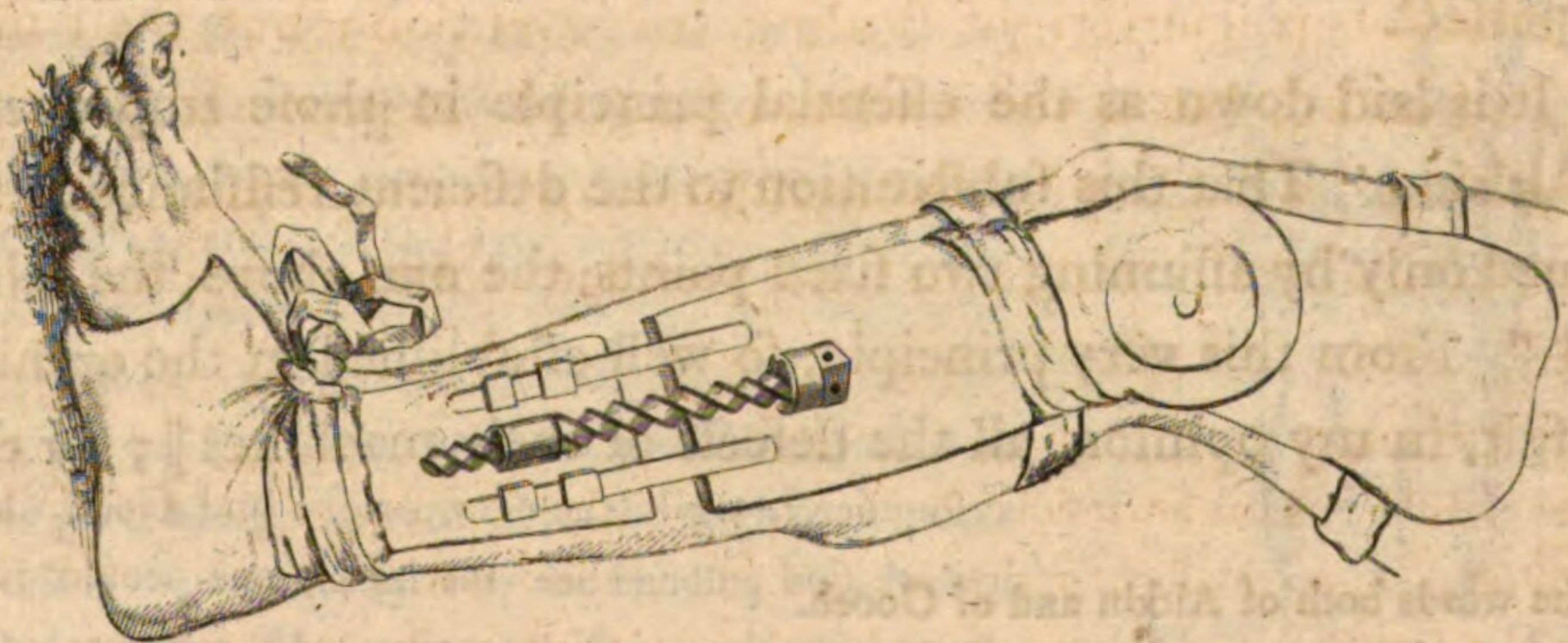
swollen and disfigured, it reminds us rather of Sir John Falstaff's sarcasm on the Prince of Wales's leg, "He wears his boot very smooth, like unto the sign of the leg."

Nothing can be more surprising than the similarity of those machines, unless it be the anxiety of the several authors to be considered as the original inventors. These authors exclaim in bitter terms against their contemporary writers, each accusing the other of plagiarism, of stealing his invention; but their mutual accusations are, after all, but a verification of a good old proverb, which we need not repeat: Aitkin has in fact stolen from Gooch, Wathen from Aitkin, and all of them have stolen from Hildanus; no wonder, then, they found out each other's thefts †.

† The machine of Hildanus has an antique simplicity, while those of Aitkin and Gooch have a most scientific complication. From the slight variety we find among these machines, one would really believe that the variation of a few screws, knobs, nails and buckles, as fairly constituted a new machine, as a new preface constitutes a new book. Upon comparing the two books of Aitkin and Gooch, I do solemnly protest that I am not only at a loss to say which had stolen the machine, which is exhibited in this plate,

I now proceed to compare these machines with the invention of Hildanus. First—That these improvers have all had one common design, viz. of extending the fractured limb, and keeping it extended, is what I suppose none of them will choose to deny. Secondly—Hildanus seems, in his first machine which he invented in the case of the little girl, to have had no other purpose in view than to lodge the thigh solidly within a firm case, to extend it occasionally with hands, and to secure it, when extended, by tying the circulars; but in the drawing of Hildanus, which I have given at the bottom of this page, it is plain that he also used machines in which the fractured limb being firmly embraced with circulars, was extended by the operation of screws. Thirdly—Though I confess it is so far honourable to those inventors that they have copied Hildanus, yet I cannot commend the spirit with which they have copied from him; they have joined two machines which he never joined; they have performed that extension by screws which he performed only by the hand, extending the limb gently from time to time; they have kept the limb extended by two iron rods, while he lodged it solidly and safely in a broad tin case; in his machine the resistance was universally diffused, in theirs it is limited to certain points of the limb. Since Hildanus at one time lodged the thigh in a simple case, and at another extended the leg by the operation of screws, I cannot but consider him as the original inventor, and these machines of Gooch, Aitken, and Wathen, as mere plagiarisms.

from the other, but which has stolen the Treatise on Fractures from the other; were I examined on soul and conscience touching this point, I could no more distinguish the two books from one another, than I could distinguish two half crowns of the same coinage: The theory and the practice, the callus, ossification, ossific juices, profusion of callus, extension, counter-extension, cooptation, bandages, rollers, circulars, straps, buckles, and all! are of one pattern.



J. Bell.

Unless I had reason to think the principles wrong, I should not inquire thus critically into the history of those machines. The principles of their inventions are two only, first, to institute some steady resistance to the contraction of the muscles, or in other terms to keep the limb in a perpetual strain, and, secondly, to make the pressure at distant and fixed points, or in other terms, to apply the whole of the force necessary for steadying the limb upon particular parts of it, while the rest of the limb is uncompressed and unsupported! But let us quote impartially those aphorisms in which the principles are laid down. First, It is affirmed, that the cause of the retraction of the fractured bones is the contraction of the muscles of the thigh; that this contraction of the muscles must be opposed by some steady and permanent resistance; "that the grand desideratum is to create a temporary substitution to the now deficient opposition which was afforded by the thigh bone to the contractility of the femoral muscles ‡,"—words which sound well, and have made no small impression. Now, the muscular contraction is a power which never ceases to act, which is indeed continually increasing, while the hold of the circulars upon the knee and ankle is continually lessening. The muscular contraction is rather excited by being opposed, and when excited is irresistible: it is this power which breaks the bone in fracture of the patella, and tears the tendon in rupture of the tendo-achillis! How then should such machines resist it? But even allowing that such machines have power to resist the muscles, and strength enough to preserve the extension, how shall we enable the soft parts to endure such force, or how give them a perfect hold upon the limb? make but soft parts surrounding a joint uncompressible, so as to give a permanent hold, make them as hardy as those iron bands, so as to bear to be thus grasped, and I will acknowledge the most powerful machines to be the most perfect.

Secondly, It is laid down as the essential principle in those improvements of Gooch and Aitkin, "That this substitution to the deficient resistance of the bones can be obtained only by assuming two fixed points, the one above, the other below the fracture ‡." From this very principle, so well established in the opinion of the inventors, result, in my opinion, all the defects of their machines ||; for that pres-

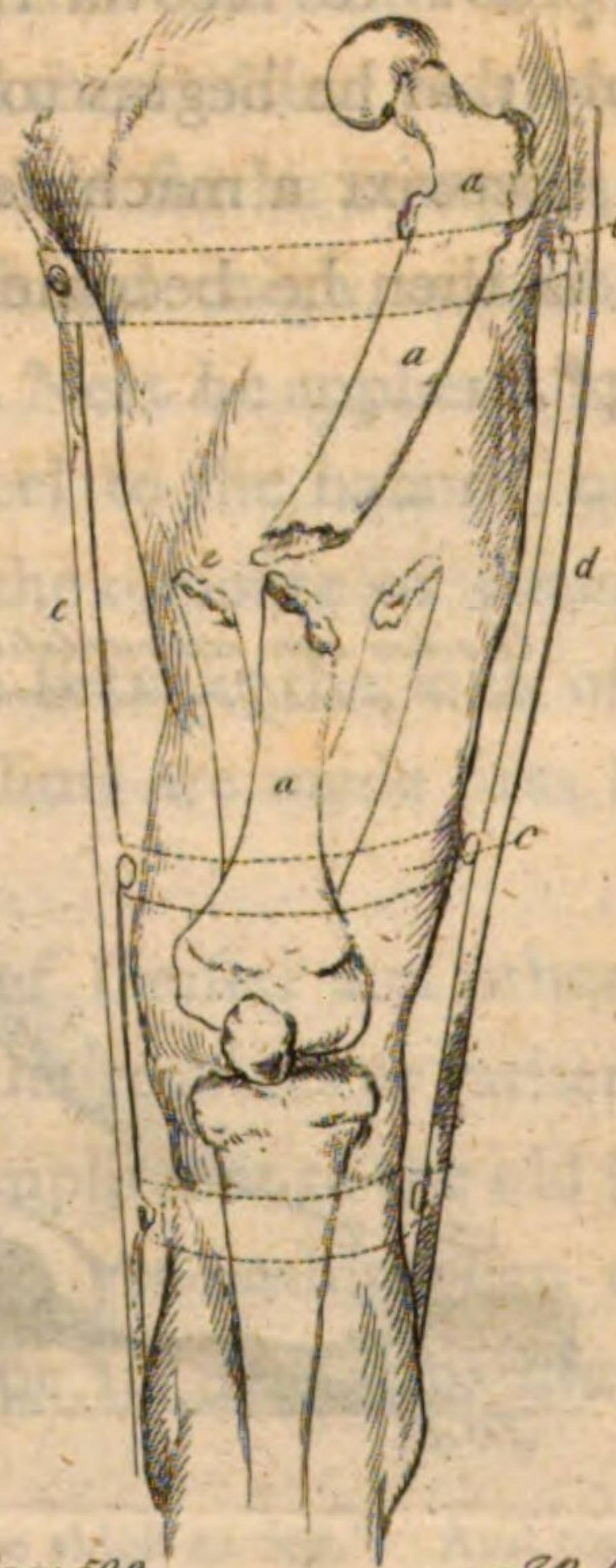
‡ These are the words both of Aitkin and of Gooch.

|| The inventors of this machine have fallen into great mistake when they think to commend it, by saying that it operates only upon two distinct points of the broken bone. I am indeed satisfied that no machine

ture is made at three distinct and distant points, which might have been diffused over the whole limb! in order to exert but a small degree of force, the ankle, knee, and pelvis are sorely pressed; there is at those points a partial and painful stricture, with intolerable galling, which the padding of the circulars can never prevent; the limb rests upon no flat surface to keep it steady, but is wholly insulated, those points alone being compressed: in place of a great resisting power, which might have been easily obtained by a general bandage, which gives to every point its share of pressure, and of course its share of resistance, no more than a very slight resistance is obtained, and that too by squeezing the knee and ankle in these iron circulars with great pain and intolerable galling. The limb is thus held continually as in the grasp of two cruel hands for six weeks, and while the heads of the bones are squeezed with intense firmness, the middle fractured part is left unsupported.

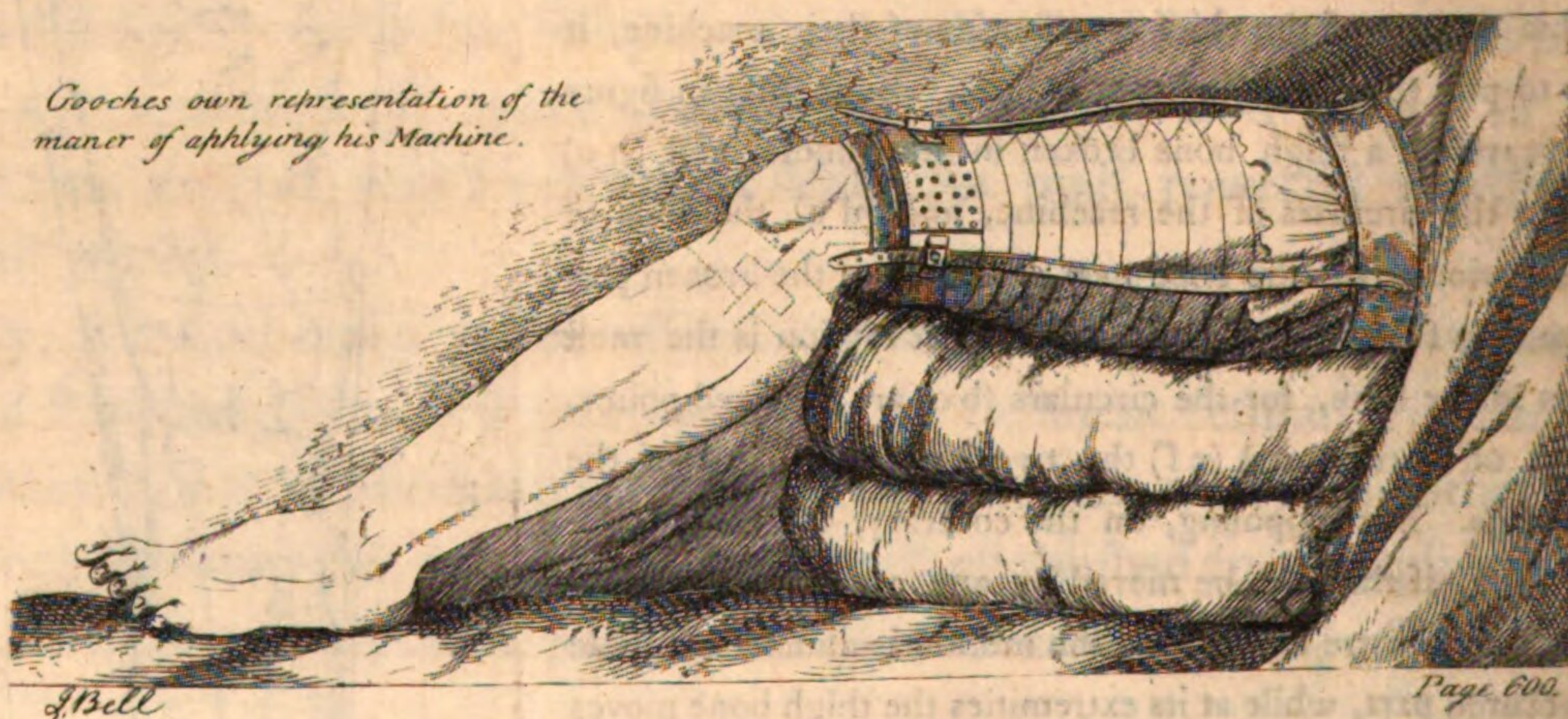
But of all arguments that of experience is the fairest, and these machines have now been tried by time, that severe justicer, who respects neither authorities nor names. There is no reason why I should mention to you the experience which I

will operate to advantage which does not extend beyond both ends of the broken bone, and so far this machine of Gooch and Aitkin is good. By all the ideas I have of the condition of a broken limb, the circumstance of steadying it seems to me a matter of infinitely less importance than authors have in general thought it; but since Dr. Aitkin and Mr. Gooch have mentioned this as one of the chief excellencies of their machine, it is proper to put this point in its true light. Supposing in figure (a a) to represent a thigh bone broken in the middle, and (b c) to represent the circulars of the machine, and (d e) the rods of iron, it is obvious, that the bone may vacillate at the broken part (e f) from e to f; and it is obvious that such motion is the most dangerous to the limb, for the circulars (b c) are the fixed points, the centres of motion, and (e f) the two extreme points of the moving radius. But supposing, on the contrary, the thigh to be left free, then, if the limb be moved by any accident, the fracture itself is the centre of motion, the motion is almost insensible at the fractured part, while at its extremities the thigh bone moves widely; and this is the true reason why the bending of a broken limb does so little harm. The extremity changes its shape in a very great degree without any remarkable motion in the immediate place where the fracture is, because it is the centre of motion.



an individual have had, since the total disuse of those machines expresses very unequivocally the opinion of the whole profession; but could I venture to represent to you, the contentions I once entered into with a stubborn and sturdy highlander in our hospital, who had fractured the neck of the thigh bone, I think it would cure you of all desire to repeat the trial. I have on several occasions tried those machines with that impartial zeal with which it becomes us to receive any suggestion, especially in a case of such acknowledged difficulty. I have reinforced Mr. Gooche's and Aitkin's machines, with additional buckles, belts, and screws, but I have only screwed my patient into a state of indelible torture, in which neither he has had the courage, nor I the cruelty to persevere.

Perhaps there cannot be a more awkward situation than that of the surgeon, who, trusting the unqualified encomiums of the authors of those inventions, has congregated his carpenters, smiths, saddlers, and bellows-makers, and set them to work! and after screwing his patient into a state of exquisite torture, is forced with shame and confusion to give up the point, and to lay out the limb smoothly upon a pillow to recover from the galling and bruising of his machines. It is then only that he begins to perceive the wide difference betwixt speculation and practice, betwixt a machine put about a sound limb, and a bruised and fractured one; it is then he becomes sensible how easily an untruth may be told in a drawing*.



* Such drawings are just indirect lies; the surgeon never reflects upon the swelled, miserable, and disordered condition of such a limb, and the artist who makes the drawing knows nothing of these matters. The surgeon lays down his machine before an artist, and says, "Draw me that machine:" Then he says,

Next in order is the method used by Mr. Dessault for extending the fractured thigh: I wish sincerely I could speak of his invention with a degree of respect at all proportioned to the deference I feel for one who was undoubtedly a great surgeon, diligent in his practice among the poor in the Hotel Dieu, and kind and encouraging to the young surgeons who served under him, and who in return testified their gratitude by writing out his cases and observations †. His theory is unworthy of his high character, his intentions, and indeed his very words, are anticipated, not merely by old surgeons, whose works he might have neglected to read, but by his immediate predecessors and contemporaries, Petit, Sabattier, and Duverney. He was in the custom of applying the long splint of Duverney with as much anxious preparation, as if he had trusted to that alone, while his peculiar method, that on which he entirely depended, consists in fixing the patient to the head, and drawing down the heel towards the foot of the bed by laces or bandages fixed round the ankle, a method neither original nor successful, not even consistent with the splint which he applied at the same time.

First, Mr. Dessault applies round the broken thigh bone (supposing it broken in the middle) one compress above the place of fracture, and one below it; over these compresses he applies an eighteen tailed bandage, and then taking two long pads or cushions, he lays them along each side of the thigh; thus far he complies with the rules of the veteran surgery,* he binds up the fractured thigh with these compresses and cushions to fill the hollows of the splints. Next he applies a long splint about three inches broad, and reaching from the heel to the haunch, or beyond it, while he lays a shorter and smaller splint along the opposite or inner side of the thigh. The long splint is secured by being let in betwixt the folds of a table-napkin bound firmly round the pelvis, while both splints are made firm by bands of ribband or tape tied round the whole.

Here there is nothing different from the methods of Heister and others, but it seems a mere compliance with the customary practice, he troubles or rather tortures his patient with this complicated apparatus in mere compliment to the old surgeons, and then with all possible sang-froid concludes, "That yet nothing can effectually oppose the displacement of the thigh bone, except such an apparatus as shall

"You must make me another drawing, and put the machine upon the thigh or leg." And thus, in place of a true representation of a broken and swelled leg, with these cruel irons and buckles fixed about it, we have presented to us a limb lying in its gear, nice and tight as a girl in her new boddice.

† This is the manner in which Mr. Dessault formed his Surgical Journal.

prevent the trunk gravitating towards the thigh, and the leg, on the other hand, being retracted towards the trunk †."

This is the peculiar theory of Dessault, and the additional apparatus which he next applies he boasts of as his own invention, and as the constant and successful practice of the Hotel Dieu for three years ‡. The roller, the cushions, and the long splint of Duverney being applied, Dessault is next to prevent the gravitation of the body (or in plain terms the trunk sinking downwards in the bed), and the retraction of the leg. First, he puts a large folded cloth, napkin, girdle, or roller round the thorax just under the arm-pits, to which are fixed those bands by which the patient is tied up to the head of the bed, and the body prevented from sliding down, from descending or gravitating towards the fractured limb. "Next (says Mr. Dessault) nothing is more easy than to prevent the thigh being retracted towards the pelvis §," and for this purpose the ankle being encircled and defended with a long flat compress laid round the back of the leg and round the ankle, the middle of a common roller or bandage is to be applied round the heel, turned round above the ankles, crossed upon the fore part of the foot where the buckle lies, and tied over the sole of the foot; this roller carried to the foot of the bed, is fixed there.

Thus does Mr. Dessault accomplish that perpetual tension of the limb, which he decorates with the fine name, "Permanent extension;" but how he can regard this as peculiar to any period of surgery, as the exclusive practice of the Hotel Dieu, or as an invention of his own, I am at a loss to divine. The doctrine (since we must call it a doctrine) was announced by Mr. Petit in a very formal manner, and he was accustomed to fix the lac or ligature, which is designed for preventing retraction of the thigh, to the foot of the bed, while a large tablecloth fixed to the top of the bed, and passed round the groin, supported the patient, and prevented the trunk

† Le seul appareil qu'on puisse opposer efficacement au déplacement des os dans les fractures obliques du fémur c'est celui qui empêchera le tronc de se porter vers la jambe et la jambe de se porter vers le tronc.

DESSAULT.

‡ L'on opposa à l'action de ces parties un moyen qu'on emploie depuis trois ans à l'Hotel Dieu et qui y réussit constamment dans les cas même les plus difficiles.

§ Le blessé étoit déjà fixé au chevet du lit par des bandes qui partoient d'une large ceinture placée sous les aisselles et par conséquent le tronc ne pouvoit descendre : *il ne s'agissoit donc que d'empêcher la jambe de remonter vers le bassin, et la chose étoit être facile.* On plaça sur des compresses épaisses derrière la jambe et au dessus des malleoles le milieu d'une bande dont les chefs croisés sur le dos du pied puis noués sous la plante alloient s'attacher aux pieds du lit.

descending towards the fractured limb †. There is, indeed, nothing peculiar in the method of Dessault, except the precautions which I shall now mention: First, That in place of applying his bandage for extension round the lower part of the thigh, where the veins and arteries being subject to compression a swelling of the whole limb might ensue, Dessault applies his lac round the ancle, where, from there being less of the bulk of the extremity below the ligature, and the vessels being defended in some degree by the projection of the ancle bones, there is less danger of swelling. Yet this precaution of Dessault's is far from being either new or effectual; for Hildanus, when instructing the young surgeon how to apply these very lacs, acknowledges, that though commonly applied round the knee, they may be better applied round the ancle: "Si quis tamen cingulum tibiæ circa talum adaptare voluerit non erabit." But should you incline to apply the lac round the ancle in place of the knee, you may with all propriety do so. And Mr. Sabattier (who wrote a paper on the subject before this publication of Dessault's) proves not only that this permanent extension has been at all times a very common practice ‡, but also that it is a very dangerous one. "The consequences (says Sabattier) of this method, are so distressing, that nothing can persuade me that it is not very dangerous; for the thigh and ancle are prodigiously swelled by the compression of the lacs, while the parts are excoriated by the filth of urine and the odor with which the bands are continually soiled; while some have suffered much from continual fever and irritation, others have died in unspeakable torments." These are strong testimonies against this practice, they are plain representations of what Sabattier had seen; but they are not mentioned by Dessault, who with particular address (and I am sorry to say it) disingenuity passes over those testimonies, while he quotes Sabattier on every other point, and leaves to us the ungracious task of confronting Dessault's eulogiums on his permanent extension with these unquestionable facts.

† "Le lacq. du genou s'attache au pied du lit pour retentir la cuisse en bas, pendant que la nappe qui est attachée au chevet du lit retient tout le corps vers le haut, et l'empêche de descendre; ce qui maintient la cuisse dans sa longueur."

‡ The writings of Sabattier prove that this permanent extension was not only a common practice with old surgeons, but that it was commonly used by his contemporaries, whence he is both entitled to represent the consequences of this kind of extension, and to describe the method, which he does in terms expressly similar to those in which Dessault explains the new practice of the Hotel Dieu. "On enferme ensuite la jambe et le pied dans des fanons, et l'on met au-dessus du genou et des malléoles, des lacqs assez longs pour pouvoir être fixés à une planche placée au pied du lit. Le lien qui a servi à la contre extension est aussi fixé au chevet du lit. Par ce moyen on continue les extensions pendant une partie du traitement."

Secondly, Mr. Dessault, as he had removed the lower bands from the knee to the ankle joint, removes the upper band from the pelvis to the thorax. When Petit and other surgeons practiced the same method, the patient was supported merely by a tablecloth or sheet passed round the groin; Dessault alleges that this would gall the patient, but Dessault's own bandage round the thorax produces not galling (which a man of fortitude could easily bear, which a man in these circumstances must bear), but oppression and insufferable distress, which no one can possibly bear. Of the difficulty of supporting the anxiety produced by this stricture round the thorax, Dessault's own cases give most unequivocal proof; his patients often were so oppressed with their bandage, and breathed so difficultly, that he was obliged to ungird them; and in one case the relief expressed by one of the patients is recorded by Dessault himself in very strong terms, though we may venture to suppose, that the patient would have used still stronger expressions. Dessault says, that when he exchanged the bandages and permanent extension for the long splint, the man was no sooner unharnessed of the girths with which he was bound to the head and foot of the bed, "than the pain of the thigh ceased, and he breathed more easily *;" but had the man been permitted to dictate his own page in the journal, he would, I dare say, have declared "that he was in heaven the moment he was unbound." I perceive Mr. Dessault is unwilling to acquaint us all at once with the whole truth; for we find by circumstances mentioned on another occasion, that the patient was so bound down that they were even unable to slip any thing under him to receive the natural discharges. His posture was as terrible as that contrived by the old lithotomists, who tied their patients not only by the hands and feet, as we do, but literally hilt to point; for besides the bandages which fasten the hands to the feet, they had another great bandage which went from the heels round the neck like a cobbler's strap, and tied the patient double.

To judge of the merits of these methods, imagine to yourselves the condition of a patient under Dessault's discipline, first laid down on one side, and bound so to the long splint of Duverney, that the body and the limb were as one piece; next a great napkin put round the thorax with all the firmness of a bandage, straps going round the thorax, passing under the arm-pits, fixed to this circular, and the pa-

* A peine fut il débarrassé des liens qui le tenoient fixé a la tête et aux pieds du lit, qu'il ne ressentit plus aucune douleur à la cuisse et qu'il respira plus facilement.

† On avoit gagné d'ailleurs la facilité de lui passer aisément un bassin pour aller à la selle ce qui ne s'exécutoit que très difficilement pendant l'application du premier appareil.

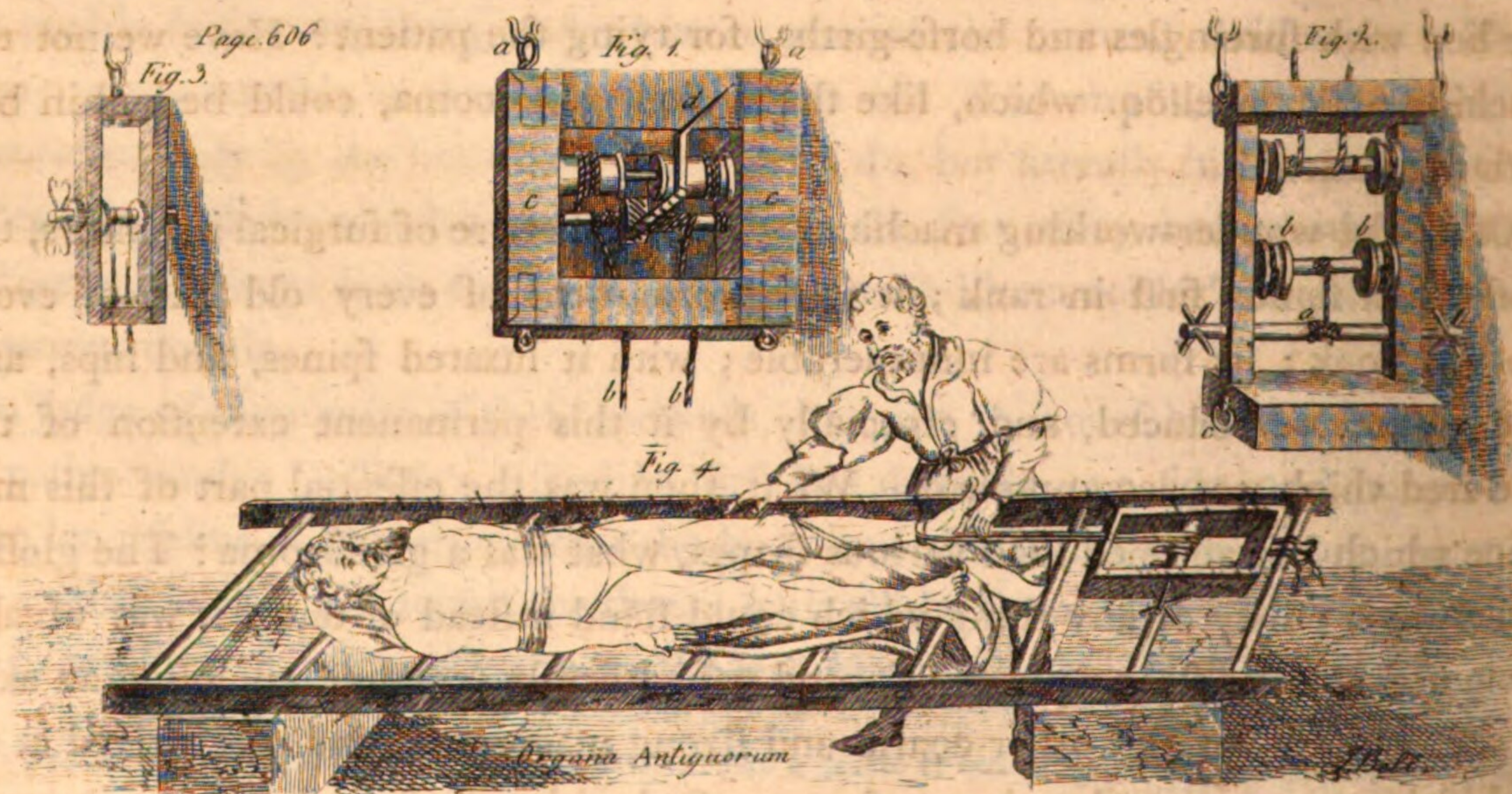
tient drawn up by these straps to the head of the bed. Next, imagine two lacs or long bandages, fixed one round the knee and the other round the ankle, one tightened when the other had caused excoriation; imagine the patient extended like a malefactor drawn by horses, bound so down to the bed that even a cloth or flat dish could not be slipped in under him, the bands assiduously tightened the moment they seemed to relax, and the thorax so bound and compressed that he could not breathe! think of all this apparatus of bandages, if you can, without holding in your breath as if trying whether such oppression could be endured. I think, for my share, I could as well undertake to live under water as in Dessault's, I might say in Damien's bed.

But why should we argue whether this be an original invention of Dessault's? for obviously this permanent extension would be the first and most natural desire of the surgeon, who would say to himself, "Now, could I but preserve the limb *permanently extended*, I must succeed in performing a cure!" nor, indeed, could any thing but the sad and painful experience we have had prove to us that a thing so desirable is impossible. Have not the surgeons of all ages used this *permanent extension*? Have we not machines and belts innumerable? Have we not the ancient Greek windlafs and ship-block, the invention of Archimedes himself, dignified with the title of Glossocoma? Have we not the jack-stone of Hildanus, which was hung to the heel, and the remora or post driven into the floor or table, which fixed the patient in his place, and prevented him slipping forward? Have we not the bed with surcingles and horse-girths, for tying the patient? Have we not the machine of Mr. Belloq. which, like the ancient glossocoma, could be laid in bed with the patient?

Of all the wonder-working machines, the chef-d'œuvre of surgical inventors, the glossocoma stands first in rank; it is the ornament of every old and of every modern book; its forms are innumerable; with it luxated spines, and hips, and jawbones, were reduced, and especially by it this permanent extension of the fractured thigh was accomplished. What, then was the essential part of this machine which has assumed such various shapes, what was a glossocoma? The glossocome was a pulley or any thing which could stand instead of one; it was usually composed of four strong pieces of wood nailed firmly together, enclosing an axis, wheels, pulleys, or any other coarse and strong machinery, and was arrived at its highest improvement when it was so connected with a fracture-box, that it could be laid in bed with the patient.

Of those engines there seem to have been three general forms. 1st, The Glos-

focoma Nymphodori consisted of four firm pieces of wood nailed together in a square form ; by the rings (a a) it was fastened to the foot of the bed, ladder, or table, upon which the patient was extended ; the ropes (b b) were fixed to the lacs by which the limb was to be extended ; the wheels or pulleys (c c c) were worked by the handle (d) ; and whether a luxation was to be reduced, or a fractured limb extended, this was the engine with which the work was performed. 2d, The Plinthium Nilei consisted in like manner of four square pieces of wood nailed firmly together, with merely a simple axis or turning spoke, with teeth, like those of a capstan, to prevent it running back. 3d, The Trispastum Apellidis feu Archimedes was still the same engine, or, as they named it, Organon ; but instead of the simple axis of Nileus, or the pulleys and lever of Nymphodorus, it had both an axis (a) and four wheels (b b), by which the velocities were multiplied and the powers increased ; it had its rings (c), by which it was fixed to the floor, table, &c. while its ropes were attached to the lacs which fixed round the limb. We find from history that neither Apellides nor Archimedes were physicians, but architects ; the glossocoma was designed for other purposes, but was adopted by the physicians of former times for the reduction of luxations and fractures, and was modelled, of course, on a smaller scale †. It was the ship-block of Archimedes which the physicians coveted, and, indeed, the coarseness and force of the machine afforded well with their doctrines and practice.



† " Illud imprimis scire convenit quod neque Apellides neque Archimedes medici fuerunt sed architecti qui machinamentum hoc excogitarunt (quem admodum nos accipimus de historia) ad naves deducendas funi-

Those three machines served but the purpose of blocks, capstans or windlasses, and were of no use till fixed to the bed or ladder on which the patient was laid. If a shoulder was luxated, they put a ladder to the man's side, thrust his arm through one of the rounds of the ladder, put the lacs round the arm, and then tied the glossocoma or Plinthium Nilei to the foot of the ladder, and put the tackle or ropes to it, so as to make it serve the purpose of a block. Was the thigh bone luxated or fractured, then they converted the ladder into a temporary bed, tied the patient's arms down close by his side, and his body to the bars of the ladder, fixed the organon, the machine (whether glossocoma or plinthium), to the lowest round of the ladder, and then proceeded, by the help of this rude tackle, to extend the thigh. This is the operation which I have represented in the 4th drawing; and always, whether the hip or the jaw bone was broken or luxated, whether the patient was to stand or lie, whether he was to be put to the rack on the ladder, over the top of a door, on the floor, or on a bed, the glossocoma was some way or other fixed near him, and was of no use till it was fixed †.

Such improvements as those coarse machines were capable of were not long delayed; from being occasionally fixed to the table or ladder on which the patient was laid, they were soon permanently joined with the bed or table, so as to form very awful engines! Of this kind was the bench of Hippocrates. It consisted of a floor six cubits long and two broad; the beams of which it was constructed were nine inches in thickness, whence you may conjecture what degree of force they expected to use; along the sides of this floor or gallery were planted six strong feet or posts, one at each corner, and one in the middle of each side of the platform, which feet stood perpendicularly up, and the axis or levers were passed through holes in the points of these. The patient, laid on his back on the floor of this machine, was tied down to it bodily; and whether the arm was to be reduced, or the fractured thigh, or the luxated spine, the lacs being fixed round the limb or round the body, were twisted by means of the axis, and the physician had it in his power to use what force he pleased, even to the tearing off the limbs. But words can give no idea of this engine of torture. The Scamnum Hippocrates, drawn at the end of this chapter, is more like the drawing

bus non per manus sed per ergatam attractis; illius autem seculi medici ejus structuræ modum minuentes, Trispastum, organum medicinale, ad luxata fractaque restituenda fabricarunt." ORIBASIUS, cap. xxiv.]

† "Quoniam tractoria organa imperfecta sunt nec præstare quicquam per se possunt sed alterius operam requirunt puta SCALE LECTI SCAMNI quæ ubi non sunt, eorum vicem exhibet pavimento terraque," &c.

ORIBASIUS de Machinamentis.

of a martyrdom, or some of the exhibitions in an Auto-de-fée, than of any surgical operation. Would you believe it, these great physicians esteemed surgery so highly, as to think it degrading to that noble art to push in the luxated jawbone with the thumbs? The man who had his jaw luxated was laid in the bench of Hippocrates, and whether the jaw had started out on one side or on both sides, he was laid flat on his back, his arms tied down along his sides and belly, his legs and feet tied together like those of a mummy; the whole man was fixed solidly to the bench, and his head being held firmly up by one bandage, which went under the upper teeth, and an opposite lac being put into his mouth, something like a bridle round the lower jaw, the two axis or turning handles were set to work †. We perceive, then, that there were as bold speculators as scientific and ingenious surgeons in those days as in our own ‡.

The machines had gone on continually improving, till at last the axis was permanently connected with a sort of trough, in which the broken limb was laid; and this was the beginning of that form of the glossocoma which was used on all occasions, whether for fractures of the thigh or of the leg. This kind of machine was a modern invention in the days of Oribasius §, it seems to have been much admired in the days of Paræus and Hildanus, but it is now antiquated, except in so far as it has been revived by Mr. Delfault, for this form of the machine (which is represented on my margin along with that of Mr. Belloq.) was not only used for extending and reducing the leg, it was meant to maintain a permanent extension, it was laid in the bed with the patient. The old authors shock my credulity a little when they say, “*Commodissime admovetur,*” “that it was a pleasant bedfellow;” for sure enough, when once applied, it was not taken off in haste, nor did they allow the patient to forget that it was there; after setting the fracture, it was their constant care, by turning the axis, to correct the tension of the lacs, making them tighter and tighter from day to day ||. This completes the parallel betwixt the

† “*Maxilla excidente sive ab altera parte sive ab utraque homo resupinatur sic ut caput juxta axem qui ab ejus parte est collocetur brachiis ad pectus atque abdomen alligantes cruribus que inter se et omnibus ad scamnum organum devinctus.*”

‡ The drawing at the end of this chapter is that of a man laid in the Scamnum Hippocrates to have a luxation of the jaw bone reduced.

§ “*Non ab re quidem mihi glossocomum videtur a junioribus medicis inventum, quod seu crus seu femur comminutum sit, ubi callus circumdatur commodissime admovetur.*” ORIBASIUS.

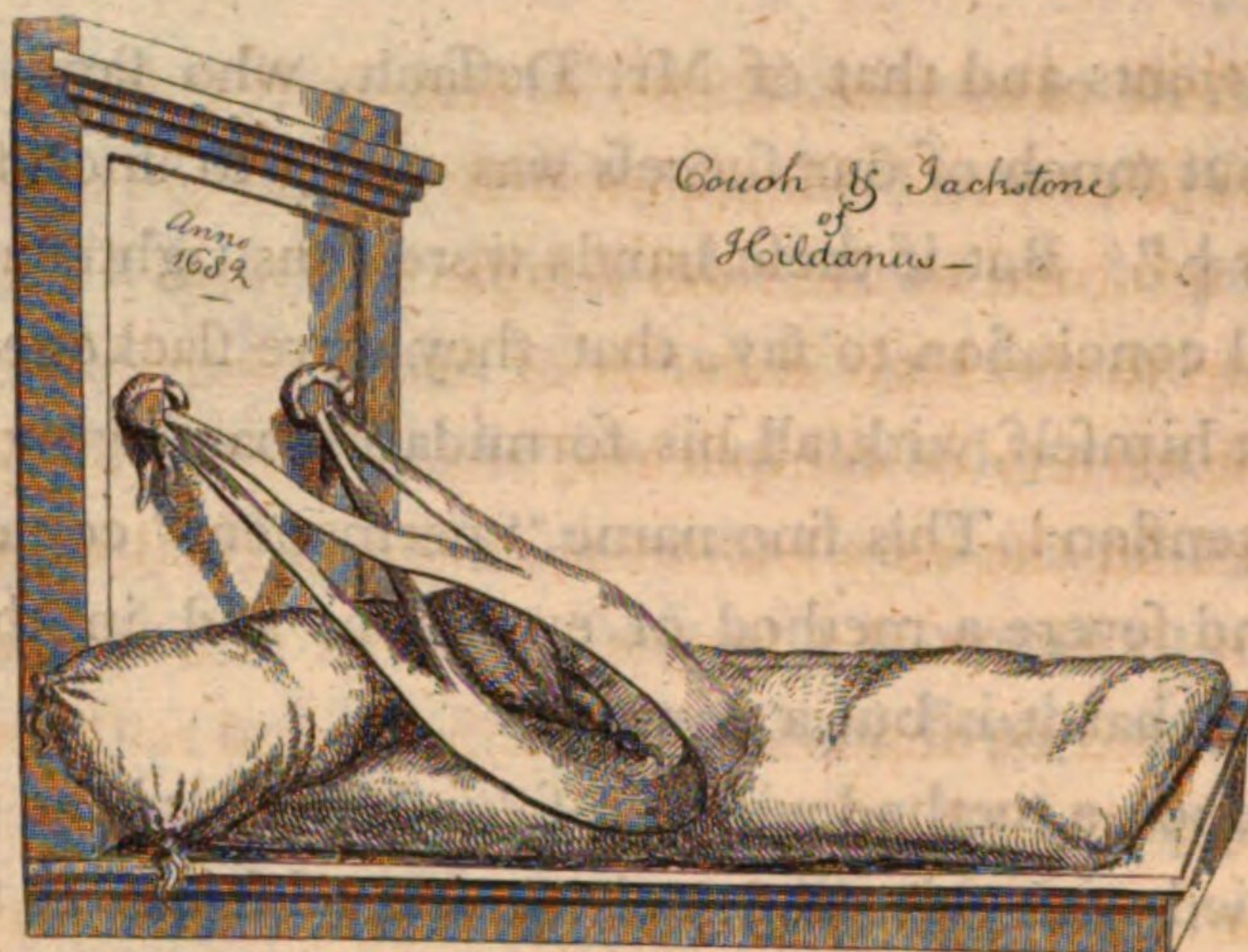
|| “*Sic ut composita fractura in posterum liceat quotidie hanc laqueorum in diversas partes intentionem corrigere valentius vel levius extendendo.*”

permanent extension of the ancients and that of Mr. Dessault, who says, "Our method has seldom failed us; but much of our success was owing to unceasing attention to tightening the bands †." But if these bands were thus tightened from time to time, it is a fair logical conclusion to say, that they were slackened from time to time! that Mr. Dessault himself, with all his formidable bandaging, never did accomplish a permanent extension! This fine name "permanent" could never reconcile me to so unnatural and severe a method of extension, and in this one sentence Dessault himself proves that it is but a name ‡.

But surgeons did at last fall upon a method which absolutely ensured the permanent extension; for being wearied with this perpetual turning of screws to tighten the bands round the ankle, they at last most happily thought of putting a pulley to the foot of the bed, and hanging a good jack-stone to the heel. I have (in next page) drawn the bed, the surcingle or horse-girth for the body, and the jack-stone of Hildanus for hanging to the heel; and according to my poor conception, the method of permanent extension was by this rendered so perfect, that Mr. Dessault could do nothing but disgrace himself by attempting any further improvement. Every step we proceed in this history weakens the plea of Dessault to originality, and, what is more important, demonstrates the folly of all such attempts. If this be not an anticipation of Dessault, if this girth do not "prevent the body gravitating towards the fractured limb, if this jack-stone do not prevent the limb being retracted towards the body," there must be something in the theory and practice of Mr. Dessault passing all comprehension.

† "Le moyen nous a presque toujours réussi, mais nous devons principalement nos succès à l'attention constant de reserrer le bandage." DESSAULT, p. 365.

‡ Galen, in his Commentary on Hippocrates, describes the use of the Glossocoma thus: "Una axis conversio pariter ambos laqueos extendit, &c. Schæma ostendit extensionem femoris diminuti; si autem sit crus diminutum laqueus superior infra genu inferior vero supra malleos aliquandus est; atque ita crus in diversa extensum conservandum." Now, far from doubting that they used the glossocoma as a means of permanent extension, like Mr. Dessault's lacs, we see that the last words of this quotation plainly imply that this machine was for making a permanent extension. Nay, farther, the use of it was universal; they put on this machine, as Mr. Wathen would put on his conductor, to convey the patient safely from place to place: "Quando patiens ex suo lecto in quo jacet, ut sternatur, transfertur in alium." By the help of it they raised the patient out of bed to have it made. I find in another place the following expression: "Si callus fuerit durior frago eum *instrumento attrahente in diversas partes* deinde sano ut hactenus docui." This implies, first, That the Glossocoma was used for conveying patients safely; secondly, That in bed the patient lay with the glossocoma continually about the limb; thirdly, That the axis was turned continually to counteract every slackening of the lacs; fourthly, They even used it (as I imagine) for extending shortened and decrepid limbs, after the callus had been formed.



page 610.

Bell.

CONCLUSION.—I have laid before you this short history of various machines, not that you may imbibe from me those prejudices I may have contracted, but that you may judge for yourselves; and I have delivered those histories in the very words of the inventors, because it is the only fair and impartial representation: “Would you hear it from our mouths or from our masters?”

Those inventors had little foresight who ventured to appeal to the ranks of crooked and deformed bones to be found in every museum as proofs of the imperfect state of surgery †. Alas! what have they done to lessen the number of the lame and deformed? Their inventions have not been neglected, they took care that they should not remain unknown; yet, have not the machines of Aitkin and Gooch been forgotten in less than twenty years? In which hospital are they used? What private surgeon applies them? Who is there to praise them? Though each machine was the occasion of writing a book, in that book only are the encomiums of them to be found. We perceive that Gooch and Aitkin are anticipated by Hildanus; Belloq. by the glossocomes of Galen, Paræus, and Vesalius; and Dessault is anticipated by Petit and by all contemporary authors. In short, the machines of Belloq. Aitkin, and Gooch, the mechanists of the present day, are more complicated than those of the ancients; the genius and inventions of surgeons seem to have been much on a level in all ages; we find the science full of schemes, expectations and disappointments; by perusing the history of these inventions, we really divest our minds of those prejudices which we are too apt to cherish even while we disavow them.

† “Habeo inter anatomica mea ossa femoris ad minimum septem vel octo in cemi collecta quorum nonnulla in medio uno pars versus coxam fracta et distorta curata fuere.” HILD. p. 476.

In reviewing the history of those machines, there is one phenomenon which often presents itself, that always after each disappointment in using the most curious machines, surgeons have returned to the most simple practice. This cannot be from indolence or disaffection to the high interests of their profession; it cannot be from the want of a great variety of complicated machines that they return to the most simple; it is, indeed, in the very moment of the highest expectation that we see their sudden turning back to the simple practice. The principle of this, I think, lies deeper than would be supposed at first sight, and is the very argument with which I would close this subject.

The resistance by which a limb is saved from being retracted is FRICTION; if this friction be all at one single point, it must be cruel, but if diffused all over the limb, it may be endured. In those ingenious machines which I have just explained, there is much show and appearance of power, but it is all concentrated in one or two points; the limb is grasped by two or three circulars; the force is of a kind which the soft parts cannot bear; the retracting power (viz. the contraction of the muscles) is continually acting, while the soft parts below the grasp of the instrument are swelling more and more, and the parts immediately surrounded by the circulars are giving way; the bands need to be frequently tightened, the side irons and screws need to be lengthened; the whole machine is gradually slipping. The ill success of machinery which touches but at points demonstrates to us that such kind of resistance cannot be made permanent like the contractions of the muscles, which always in the end prevails! the first slackening of the machine is the beginning of that yielding which allows the incessant reaction of the muscles to prevail by slow degrees.

The contrast of the leg laid out smoothly upon a pillow is, with myself at least, very persuasive, there is no pain, no show of resistance, and yet there is much. Those authors pronounced the highest eulogium on the method of Mr. Pott, when they objected to it, "That to lay the thigh out upon a pillow was to do no more than to commit the affair to Nature."

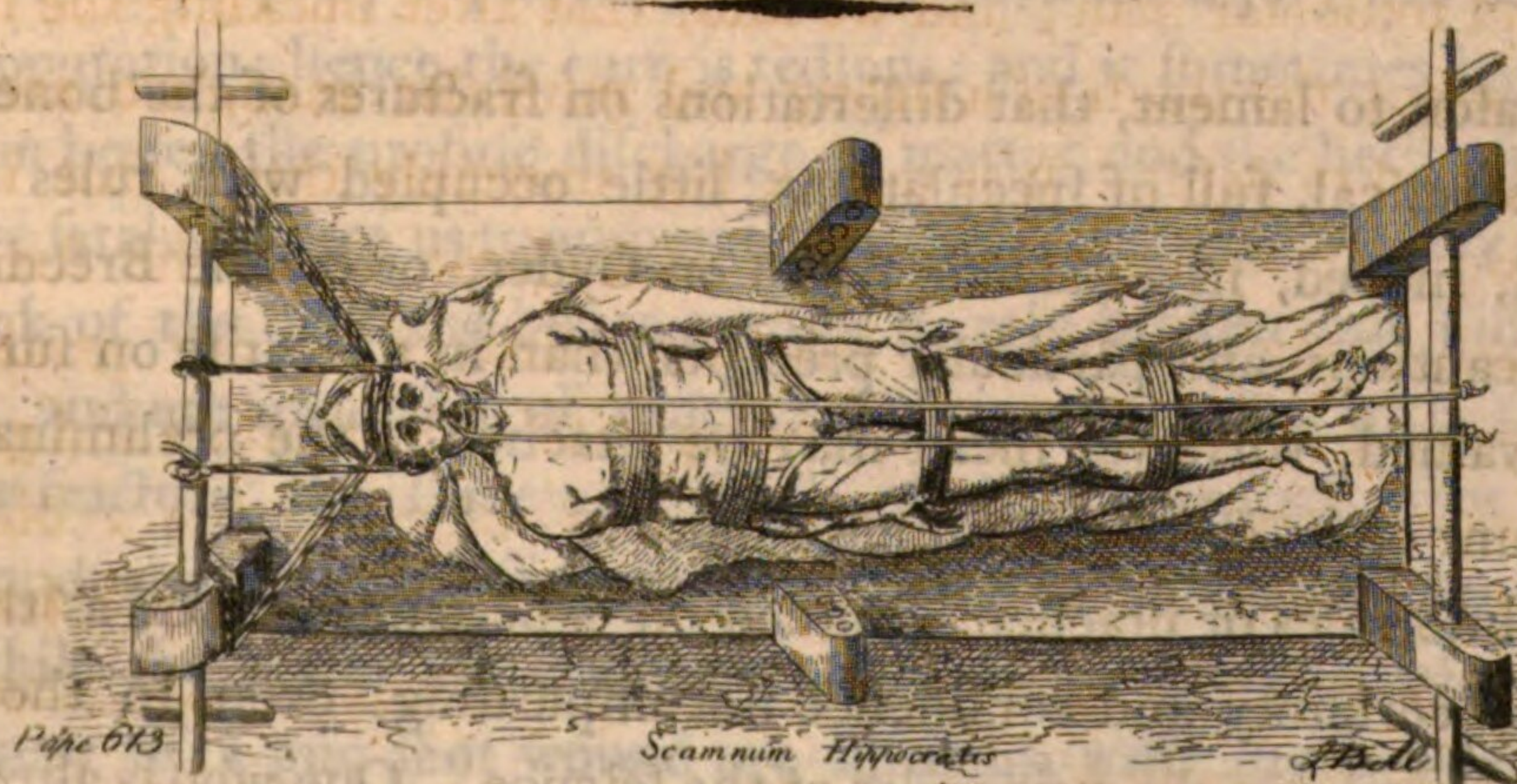
When a limb is simply stretched out upon a well made pillow, first, It is not tortured, and so the muscles are not excited to contract. Secondly, When it is stretched upon the pillow, its own weight (swelled and lame, and unapt to action, unless when excited) fixes it, and every contraction which tends to shorten the limb is encountered by a proportioned degree of friction from every point of the outward surface of the limb. Thirdly, When the limb is merely extended upon its pillow, the resistance is great; but when, beside being merely extended up-

on its pillow, it is laid in a well framed case, stiff, adapted to the shape of the limb, bending gently, so as to allow of a relaxed posture, lined with woollen cloth, flannel or fustian, to increase the friction, and the bend of the ham secured by the bending form of the case, and each hollow padded up with little cushions of tow! another splint laid on the opposite side of the thigh, the whole braced down gently with ribbands, and then both the thigh and its case bound to the pillow by tapes! the fracture is at once very steady and very easy. The resistance to contraction is hardly perceived, because it is so generally diffused! it is sensible only in its effects, not by exciting pain! there is more of gentle uniform resistance than could be derived from these torturing machines, which have seldom been screwed about a leg without being very soon thrown aside, and much greater than can be procured by that cruel extension which Dessault has decorated with the fine title *permanent*.

I have proved in a former Discourse, that a thigh may be safely extended from time to time. In this present Discourse it has been observed, that what has been called permanent extension, is actually an extension renewed from day to day. When the thigh is laid in the way now suggested, we have the fracture always under our eye; we do not go through the cruel and formal operation of extending with lacs and pulleys, and numbers of men pulling upon a broken limb which we are sensible we cannot retain in its extended position; we stretch it gently, model it with our hands, lay it out smooth, stretch and replace it from time to time. We now find by experience, that where force is required it is useless, that it is only where force is not required that we succeed; we find, that after a gentle extension, the limbs of boys and girls, or of women, of weakly subjects, and of old people, lie pretty steady; we find, that occasional extension corrects every occasional contraction; we have no difficulty, except in the thigh of a strong and muscular man; and we find, that after buckling the most powerful machines about the thigh of a strong and muscular man, we are invariably foiled, and obliged to desist. It is only a big unweildy thigh that is much retracted, and we find by experience, that after some time, the strenuous contractions of such a thigh subside, its irritable resistance to our gentle extension ceases, it falls into a quiescent state, allowing itself to be soothed and gently drawn out and laid along upon its pillow! I have often observed, that a big and muscular thigh at last settles down as it were in its place, and takes a seat and posture, so that it is not easily discomposed by any accidental spasm, contraction, or unwary motion of the patient.

These explanations I owe to you as young and inexperienced surgeons, and will venture to foretel, that after being like others seduced to use powerful machines, to this simple process will you at last return. The fractured thigh bone seems in a strong man to be retracted by natural powers, which nothing but rude force could successfully oppose; surgeons have delighted in force! their machines are but too powerful! We know by experience that the resolution of man cannot sustain the tortures of a limb extended by machinery for weeks. We question not the power of machinery in extending a fractured limb, but it is much to be questioned whether the system be able to suffer such protracted torture; if it be, it is at least a phenomenon which I have never witnessed, nor expect to see. Wherever extreme violence is required, I hold it to be a sign that violence will not succeed.

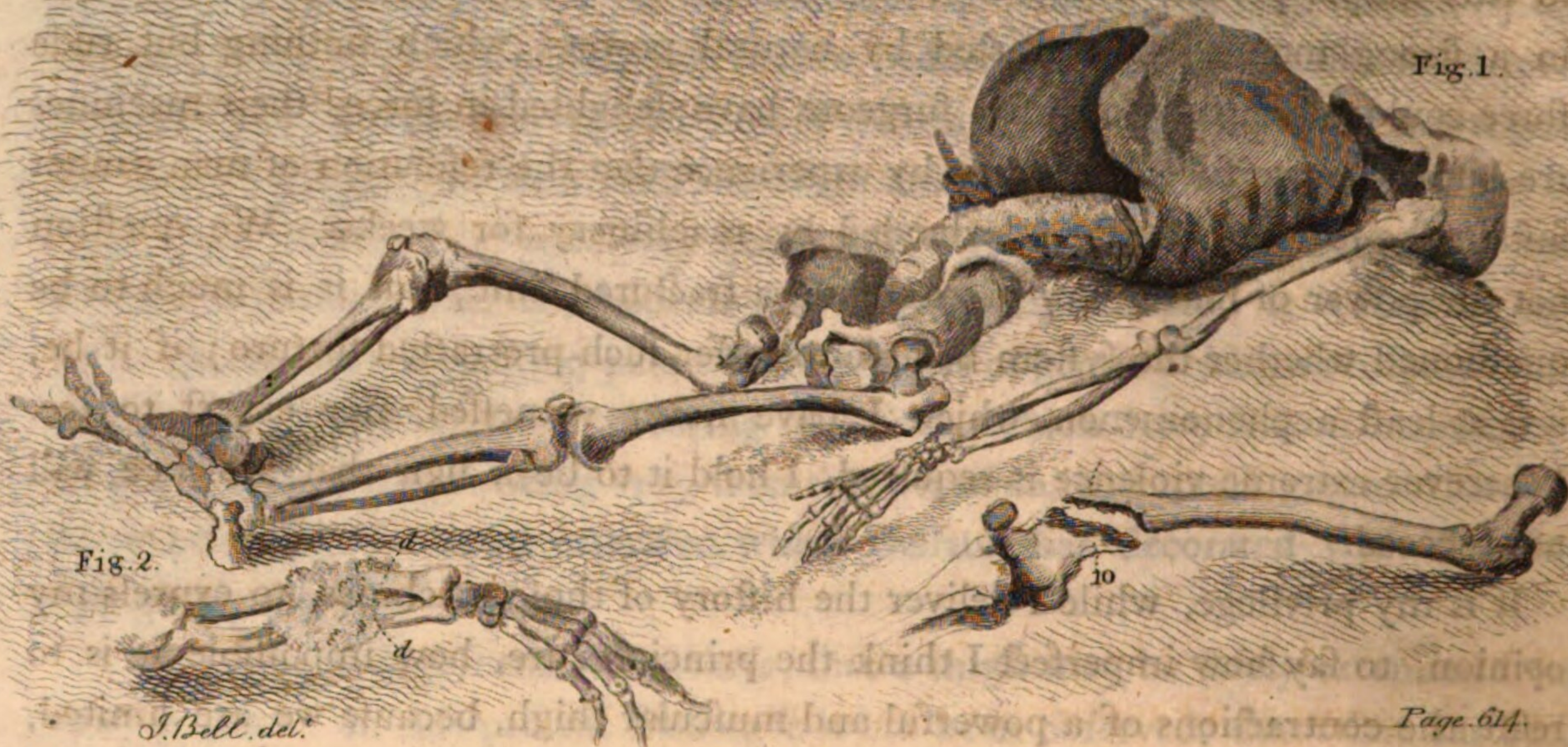
It is my privilege, while I deliver the history of those machines, to express my opinion, to say how imperfect I think the principles are, how impossible it is to resist the contractions of a powerful and muscular thigh, because we are limited, not in respect of the extending power, but in the properties of the soft parts of the limb to which such power is to be applied. I also venture to appeal to the bones of museums and charnel-houses in proof of my opinion. Bring me one thigh bone of a full grown man fractured in the neck, and not shortened during the cure; bring me a bone so united, either before or since the invention of modern machines, and I consent that you torture your patients with screws, rods, belts and pulleys, till you be weary of cruelty, and convinced with Platner, "that the thigh bone fractured in its neck can hardly be preserved of its natural length."



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Scamnum Hippocraticum

1750



DISCOURSE XV.

RULES FOR THE MANAGEMENT OF SIMPLE, COMPOUND, AND GUN-SHOT FRACTURES, DEDUCED FROM THE PRACTICE OF THE BEST SURGEONS, AND FROM THE DOCTRINES EXPLAINED IN THE PRECEDING DISCOURSES.

WE have reason to lament, that dissertations on fractures of the bones have been defultory, theoretical, full of speculations, little occupied with rules of practice. You will find, indeed, in a didactic poem on Cyder, or on the Breeding of Bees, more sound, cautious, and particular precepts, than in a treatise on surgery, which ought to be valued, whatever merit may be attached to the preliminary theories, only on account of its clear and simple rules.

From absolute rules of practice, founded on experience as well as theory, there arises a sort of certainty and confidence not unpleasing, even to those who have studied very thoroughly the principles of the science. One who is already initiated

into the principles of the science learns perhaps, from such rules, nothing absolutely new, but he learns in a manner entirely different; things make new impressions on his mind, and of those rules which he imagined while studying the theory, he finds some refuted and some confirmed; little matters assume real importance, and he begins to perceive a wide difference betwixt speculation and practice.

One who is deep read in theory only, while he seems to understand every thing, is conscious that he can do almost nothing; he is acquainted indeed with the principles of science, but is disconcerted by the merest trifles, and is mainly uncertain how these principles should be applied. He is a philosopher handling the tools of a workman. He is like one who, when conducted through the chambers of a great manufactory, comprehends very well the force and effect of the various engines, and the powers which move them; who understands the general design of the work, and the effects of each individual process; who observes each particular workman as he passes by him employed in some little ingenious operation, so simple to all appearance that it might be performed by a child: but the philosopher has only to put his hand to the work, to be convinced that art and science should always go hand in hand, and that without dexterity of the lowest and most mechanical nature, the highest mental endowments are of no avail. But I will make no farther apology for instructing you in those little particulars of practice, which I hope you are desirous to learn.

Simple fracture is that in which the bone only is broken, the surrounding parts but little lacerated, the skin still entire; where the parts, being all enclosed by the entire skin and muscles, and kept in contact by the swelling, reunite immediately, so that the continuity of vessels betwixt the broken ends of the bone is restored.

Compound Fracture, is that where the broken ends of the bone are protruded through the skin and muscles, which are so much lacerated, that though they sometimes do reunite when properly replaced, yet often, when the injury has been great, they fall into suppuration; hence the cure is tedious; and it sometimes happens that the caries of the bones, the profuse discharge of matter, and the hectic fever and diarrhoea, prove fatal, or force us to amputate the limb. *Gun-shot fracture* is that, where, by the shock of the ball, the bones are not merely broken but killed, lose their circulation, and are incapable of renewing their connexion with the soft parts; in gun-shot fracture, the force and shock of the ball is such, that the soft parts gangrene and are thrown off in flakes, which is called the floughing of the wound! while the bones are deadened, and must be exfoliated. The internal surfaces, then, of a gun-shot wound are fistulous, with much loss of substance,

gangrenous flesh, carious bones, and fetid matter; they resemble the worst kind of caries, and are very difficult of cure. And, lastly, *Fracture* with *luxation* is an injury of such a complicated nature, the bones being broken, some great joint burst up, and the capsule and other ligaments all disordered and lacerated, that there is the utmost danger of gangrene, and it is often a doubtful matter whether we should attempt to save the limb, or should immediately cut it off; for, first, the patient, notwithstanding our well-founded apprehensions, may be saved, and may in some degree regain the use of the limb, though deformed and weak; secondly, he may in more desperate circumstances save his life by parting with his limb; and, thirdly, he may die from irresolution! for the surgeon though sensible of the extreme danger of the case, often lingers in expectation of saving the limb, till the fever and fatal gangrene come on. This constitutes the most momentous and critical question in the whole profession of surgery.

Such, then, are the definitions of the several species of fracture, and the order and succession in which I will endeavour to explain them to you; but allow me first of all to remind you of certain speculations from which I have ventured to deduce conclusions of some importance in practice. We must now endeavour to recollect the real condition of the parts.

Callus is not a mere extravasation or effusion of an ossific juice from the ruptured vessels of a bone, nor a mere concrete, which being disturbed during its concretion, is altogether prevented from coagulating; nor can those slight accidents which have hitherto been regarded by the surgeon as so destructive (and which, to the patient, must always be alarming), discompose the parts, or ruin the process. We have none of the anxieties of the older surgeons about the express and immovable steadiness of the limb, nor would we, like them, endanger gangrene by tight rollers, they used to bind their splints and compresses as firmly in every case as if the patient were delirious and struggling.

Callus, since it is not a mere concrete, but the work of active and secreting vessels, is a process to be accomplished by nature only, and over which we have no power; the vessels which form the new bone are turgid, and in high action; the vessels of the surrounding parts are also full of blood, working their contents onwards, with an increased action, towards the central point where the callus or new bone is preparing. This is what makes the swelling which we observe surrounding the fractured part of the bone. When the secretion is completed, this occasional swelling subsides, and the flow subsiding of this hard and very firm swelling, is the circumstance which persuaded the ancients that they had great power over the

callus, that the callus was clumsy at first, and that by the firmness of their rollers, the weight of their leaden plates, and the powers of their attenuating remedies, they made it disappear.

But we have rejected these bandages, we never roll a limb, we both are sensible of the absurdity, and aware of the danger of it. We cannot but remember the melancholy story of the black eunuch belonging to one of the princes of Arabia, "who having fractured his leg near the ankle joint, had it bound up very firmly by the prince's body physician with compresses and rollers above the wound; but from that moment he neglected his patient entirely, except that he gave him strict injunctions not to undo the rollers. From the stricture of the bandage there came on a gangrene of the limb; and though I made no delay (says Albucasis) in undoing the bandages, and the eunuch had immediate relief from his pains, yet so much was the gangrene fixed in the limb, that it could not be stopped, and he perished †." This is one of a few melancholy cases that Albucasis sets up in the most conspicuous part of his preface as beacons for the guidance of young surgeons; nor has there been from his time a single book on fractures in which there are not related dreadful examples of this kind; much as I have always remonstrated against rollers, I remember with horror, that a boy having a compound fracture of his arm (very desperate indeed, but so much the less a proper subject for bandage), I committed him to the care of God knows who, a man, however, in an official situation; he bandaged the fracture with a roller, and at my morning visit I found the fore arm bound more firmly than a mendicant's leg, the black skin appeared through the interstices of the roller, the hand swelled like a boxing-glove, perfectly black, and the cuticle separating; I need hardly say, that the arm fell into total gangrene.

Callus, consisting of active vessels employed in performing a certain secretion, supported by the swelling of the surrounding parts, and protected by the general entireness of the limb, is not to be discomposed by the slight motions of shifting and accommodating a pillow! While a surgeon has any such idle apprehension,

† "Et vidi medicum alium, qui accipiebat stipem apud quendam Ducem terræ nostræ propter medicinam: et accidit eunuchō nigro, qui erat apud ipsum, fractura in crure ejus prope calcaneum: et properavit medicus cum ignorantia sua, et strinxit fracturam super vulnus cum pulvinaribus, et astellis strictura forti, et non dimisit vulnere expirationem. Deinde absolvit eum secundum desideria sua. Postea dimisit eum diebus aliquot, et precepit ei, ne solveret ligamentum: et stetit sic donec apostematum est crus ejus, et ipsius pes, et pervenit ad perditionem. Vocatus sum ergo ad eum: et properavi ad solvendum ligamentum: et consecuta est tranquillitas, et evasit a doloribus suis. Verumtamen corruptio jam confirmata erat in membro: et non potui refrenare ipsam. Non ergo cessavit corruptio perambulare in membro, donec perivit."

he is no better informed than his patient, and will act with no degree of confidence. But to be perfectly assured that the callus cannot be discomposed by any slight shock, it is necessary to consider more fully what is essential to this internal adhesion, this reunion of vessels, this restoration of the natural actions of the part. In any outward wound, all that is internal reunites when closed, nor does any part fail to reunite except that which is not perfectly put together; if there be in the outward seam or lips of the wound any slight suppuration, it is because of some accidental gaping at that point, and it is to prevent such gaping and inflammation of the wound that we use stitches, plasters, the closest bandages, and even varnishing. Could we preserve the outward seam of the wound in as close contact as its internal parts, there would result no ill consequence from the want of cellular substance and living parts on the outside of the wound; but in a fractured bone, the limb being steady, and the skin entire, the internal swelling of itself supports all the ruptured parts in close contact, there can be no occasion for outward bandage, nor any co-operation on the part of the surgeon.

Thence you may imagine how very simple our practice must be. You perceive there is no affectation in a man who is old in practice protesting against all the trumpery of rollers, cushions, splints, and machines for fractures, or in laying out the fractured limb smoothly upon a pillow, to be healed by that process which Nature has appointed, and which never fails.

But this theory and these practical aphorisms are at variance, not only with the



This is the drawing of the boy's gangrened arm mentioned in last page; it represents the condition in which I found the hand and arm the day following the accident. Upon dissecting the arm, which actually dropped off, I found the bones of the fore arm so shattered that it could hardly have failed to fall into gangrene; but with such a bandage round it, it could not escape.

old practice, but with those instructions about extension and bandaging which are copied from book to book ; for though surgeons are gradually sliding into more simple and sensible methods, it is only through the individual operations of common sense, that a few strong-minded men have in the course of practice been enabled to forget the precepts of the school books, and have by their own natural good sense discovered the folly of bandages. System-writers still retain the old descriptions and terms of art, of which there is not one that does not imply an absurdity. Of these the most conspicuous are, EXTENSION, COUNTER-EXTENSION, COAPTATION and DILIGATION ; what others there may be I hardly remember, but these are the most magnificent terms, the most favoured by the vile pecus imitatorum, who are characterized by Guy de Chauliac as regular birds of passage, to be expected at certain seasons, and “ which follow each other like wild geese, all in a row †.” These terms were descriptive of operations which were actually performed by the glossocomas of the ancients, and by the block and tackle of the modern surgeons.

Extension was the fixing of lacs and bandages upon the lower part of the fractured limb, to which were applied ropes and pulleys, by which the assistants pulled. *Counter-extension* was the resistance which other assistants made by tablecloths, girths and bandages, put round the pelvis and upper part of the thigh. *Coaptation* was the thumbing and working the smaller fragments and the broken ends of the bone into nice contact with each other ; but *diligation* was a process which it would take hours to describe, as it took hours to perform ! of compresses applied round the broken ends of the bone, pads and cushions laid along the sides of the limb, splints above these compresses and cushions, with distinct rollers for each several stage of the operation ‡. Such practices are, or soon will be, totally disused by all sensible men, nor will the terms be allowed to remain as memorials of those absurd cruelties, or as stumbling-blocks to young students, who read about these, aye, and about more desperate operations, which never will be performed again ||.

† “ De imo tamen miror, quia ita se sequuntur sicut grues unus non dixit nisi quod alter.”

GUIDONIS de Cauliaco Chirurgia Capitulum Universale.

‡ See the plate, page 493. of bandaged limbs.

|| I mean certain operations of cutting out tendons and nerves, when entangled betwixt the fractured ends of the bone, or cutting out irregular splinters of the bone in fractures of the ribs, sternum, &c. which I do not choose to say any more about ; only let my pupils beware, that wherever in any book they read about such operations as disentangling tendons and nerves, by making an incision into the fractured limb, they are reading what never should have been written, and never can have been practised ; no operation of this kind ever has been performed, even by those who are so ignorant as to write such directions, and so imprudent as to address them to students and learners in surgery.

But I will describe the real operation in plain words, in which there is no occasion for any such terms as extension, counter-extension, diligation, rope, pulley, compress or bandage ! That is indeed rampant surgery ! Were it possible for a limb to require such extension, it never could be maintained. When a limb, the leg, for example, is broken, you need no nice and critical diagnostic signs to distinguish the fracture by ; the broken limb yields under the weight of the body, the patient hears and feels the snapping of the bone at first, and is sensible, when the limb is moved, of that grating of the broken ends of the bone against each other, which was in the old vocabulary termed Crepitation ; and the surgeon, when he begins to handle the limb, is sensible of the same grating, he perceives by the bending of the limb that it is broken, and there is indeed so little difficulty in distinguishing a fracture, that I have never seen a patient who was not sensible of his condition, nor heard of a surgeon setting a sound limb, *except by design*. In setting this broken limb, there is no extension required but such as common sense would direct you to use if you were not a surgeon. You lay the patient in bed, and lay the limb on a pillow, or if you design to use splints, you have two long troughs or pieces of pasteboard bent into a hollow form, lined, or rather cushioned, with two or three plies of flannel, and with tapes or ribbands, four or five in number, attached to the outside of one of the splints, by which both splints may, after all is over, be gently tied together with bow-knots, to be slackened or tightened according to the swelling of the limb ; you also soak and soften the pasteboard a little, that it may take a shape suitable to that of the limb.

A long splint of this kind being laid flat upon the bed by the side of the fractured leg, you desire one of your assistants to apply his hands broad round the upper part of the limb, and grasp it gently and steadily ; you take the foot and ankle in the same manner in your own hand ; you slip, perhaps, your left hand under the broken part of the limb, and thus you and your assistant carrying, or rather sliding the limb gently along, lay it upon its pillow (which should not be a common one, but rather like a mattress or settee pillow flat and firm), or upon its splint.

Then you begin to lay the limb smooth ; your assistant grasps it again by spreading his hands upon the thigh or below the knee, with the design of extending along with you, not by lifting the leg from the pillow, but rather by spreading his hands over it, pressing it down to the splint or pillow, and steady- ing and holding it by the pressure, while you, with both hands, lift the foot and ankle, grasp them gently but very firmly, raise them a very little from the pillow

or splint, and draw gently, steadily, and smoothly, and when you have extended and smoothed the broken leg in a manner which you almost suppose agreeable rather than painful to the patient, you press it down upon the splint, you and your assistant both keeping the limb steadily and gently pressed down. You keep it flat and pressed with all your hands till it gets a sort of seat and bed in the pillow; or if splints are to be applied, the limb is now pressed against the lower splint; the upper splint is then laid above it by a third assistant; you now grasp the limb with your hands on the outside of the soft and moistened splints; you grasp and model them a little, and when the whole has taken a form, you tie the several tapes one after another, and after having tied them in a general way, you go over them again one by one a second time and tie them a little closer, so as to keep the limb agreeably firm.

There is in this description, you perceive, no mention of those high-sounding terms which were so peculiarly descriptive of the grand surgery of the old masters; if we must retain them in our modern nomenclature, there should be associated with them no ideas of lacs, and pulleys, and assistants pulling at a fractured limb. Extension means, the surgeon gently drawing out the fractured member; counter-extension means no more than some friend or assistant holding it firm above; coaptation means only the smoothing of the limb and grasping the fractured parts in the hands, and pressing it so down upon its pillow or splint as to give it a sort of seat; while the diligation is a thing to be quite forgotten. There is much virtue in a word; many a lameness, and not a few gangrenes, may be imputed to this term diligation†.

Yet these directions, though plain, simple, and manifestly consistent with common sense and the best principles of pathology, will give you little confidence unless you be satisfied that they can be safely applied to each individual case, and that no other rules can be applied with good effect.

RULES FOR THE SETTING OF SIMPLE FRACTURES.

It is manifest that a fractured limb needs only to be laid even and moderately

† I here am careful to describe the common operation, and that only; there are certain cases afterwards to be mentioned, especially of compound fracture with protrusion of the bone, where a more powerful extension is necessary, but still neither pulleys nor ligatures are used, only, the surgeon sometimes twists a hand towel round the ankle to give him a steadier hold.

steady, to be perfectly reunited without our help; but if a person were drunk, delirious, or maniacal, it would need to be bandaged! for the same reason, if a fractured bone be in danger of being moved by the unavoidable motions of the body, or by the natural functions, as respiration, it surely must be bandaged.

1st, *In fracture of the HUMERUS or ARM BONE*, the patient is not to be confined, he is not to lose his health on account of this trivial accident; and since he is to walk about, the motions of the body and swinging of the arm would necessarily discompose the bones, and absolutely prevent their reunion. The fracture of the arm bone then is to be set with two small flat splints of pasteboard, lined with flannel and rolled with a roller gently, but not carelessly applied, because the common splints merely tied with tapes would slip off, and because the arm hangs naturally away from the body, so that it is easily rolled.

N. B. When the fracture is near the lower end of the shoulder bone, near the condyles, as at (a) (*vide* figure at the head of the chapter), or in what is improperly called the neck, viz. near the head of the bone at (b), it is apt to be more oblique, and then firmer splints, a steadier bandage, and more careful posture of the arm is necessary; and when it happens that the shaft of the shoulder bone is separated from its head, the axilla should be filled with a compress to keep the bone out and in its right direction.

2d, *When the FORE ARM is fractured*, although one bone only be broken, it is easily distinguished, because the slightest turning of the hand produces rotation of the RADIUS, and consequent crepitation, the radius being fractured; whereas, when the ULNA alone is fractured, the change of shape is almost as great as if both bones were broken. When one bone is broken, the arm manifestly cannot be shortened, and even when both bones are broken, the general surface formed by the two bones and their interosseous membrane is so broad, that they are fairly opposed to each other, and soon reunite. The fracture of the fore arm requires two flat splints which are to be laid one on the inside, the other on the outside of the arm, and in place of rolling the fore arm with a roller, I usually tie the splints with three or four broad tapes or ribbands, each about a foot in length, not connected with the splints, but laid upon the table under the lower splint when the arm is about to be laid upon it.

N. B. In the fore arm I have remarked two things, first, That the hand must not be turned in any degree, i. e. it must neither be in what anatomists call a state of pronation, nor a state of supination, but the thumb even with the line

of the Radius, and the little finger with that of the Ulna; and to preserve it in that position, the splint that lies on the inside of the arm must be long enough to reach to the palm of the hand, so as to keep the wrist steady, and prevent rolling of the radius; and this splint, where it is lodged in the palm of the hand, must be a little padded and a little bent, so as to let the fingers bend easily over it.

Observe also, that the representation I have given of the adhesion and massing of parts about a fractured bone, is so far true, that the callus is formed, not by the particular ends of each individual bone, but by the whole mass of bone, inflamed periosteum, and cellular substance; whence it often happens, especially in compound fractures, where the mass of parts engaged in the process is great, or in gun-shot fractures, where the arm, from the tediousness of the sore lies very long extended upon its splint, that the ends of the bones are united in one mass of callus, by which the motion of the radius is hindered, and of course the turning motion of the hand is lost. This produces a more awkward and distressing kind of lameness than you would easily imagine, the patient cannot carry any thing to his mouth without turning the arm at the shoulder, the effect is the same precisely with that of an ankylosis of the elbow joint. This massing of the bones together, is represented in the plans at the head of this chapter, where, in figure 2, the letters (d d) express the mass of cellular substance, &c. surrounding the bones and generating the callus. I saw several examples of this at Yarmouth in the Dutch hospital, where men shot through the fore arm had been permitted to remain in their cradles all the time of the cure, their arms lying all the while flat and unmoved, till at last they became immovable.

3d, *In fracture of the CLAVICLE, or COLLAR-BONE*, the weight of the arm pulls down the scapula, for in fact the clavicle is the only connexion the scapula has with the trunk; the scapula itself only glides upon the ribs, without being connected with them, large muscles lie betwixt the lower flat surface of the scapula and the thorax. The clavicle then supports the scapula and shoulder, and when it is broken, the shoulder falls forward, the shoulders seem narrower, the pain is greater than in other fractures, because the fracture is always oblique, and the weight of the arm and shoulder makes the one end of the broken bone fall under or shoot past the other. The accident is easily distinguished, as the bone can be felt in its whole length; perhaps there never was a patient sober enough to know any thing of his own situation, who was not conscious of the nature of the accident that had befallen him when the collar-bone was broken.

This particular fracture is both reduced and retained, by first pulling both shoulders strongly backwards, and then turning a firm linen roller (*vide* fig. 24, page 140.) round the shoulders, crossing upon the back, so as to leave the place of the breast where the fracture is, exposed and open; for this no more requires splints nor compress than any other fractures, it is only in consequence of the weight of the arm that the fractured clavicle requires firm bandaging.

N. B. This particular fracture is rarely accompanied with wound, nor is there any difficulty in reducing or retaining the clavicle in its right place; but sometimes it may be useful to fill the axilla with a large compress in order to support the shoulder and to keep it off from the thorax, so as to extend (if we may use such an expression) the broken clavicle to its full length. When the arm is big and heavy, when the patient has to complete his journey in a carriage, &c. it is proper to add to the figure of 8 bandage round the shoulders, another bandage supporting the fore arm and confining it close to the body. This second bandage is indeed necessary in every case, to prevent the swinging of the arm and the unavoidable rolling of the collar-bone.

In respect of the fracture of the acromion process of the scapula, it may be sufficient just to remark, that it also is known by a falling forwards of the shoulder, and the place of the fracture is easily distinguished as the bone is superficial. This fracture requires chiefly that the shoulder should be pushed upwards, by which the head of the shoulder bone, pressed upwards against the fractured process of the scapula, raises it to its right place. In this fracture, the shoulder must be bound firm, and the fore arm particularly well supported.

4th, *In fracture of the STERNUM*, the broken bone is moved, not by the motion of the trunk or body, but by respiration; at every motion of the thorax the patient is sensible of the grating or crepitation of the bones, the surgeon feels it with his hand, and hears it by approaching his ear to the breast. The motion of the broken sternum soon inflames the mediastinum under it, and by degrees the inflammation extends along the pleura and whole of the thorax. There comes on a frequent cough, and during every paroxysm of coughing, the crashing of the fractured sternum is dreadful.

This fracture admits neither compress nor splints, and yet it must be kept perfectly steady; to do this, nothing is required but a simple swathe or bandage round the chest, but it must be made so firm as to prevent the respiration being in any degree performed by the motion of the thorax; the motions of the thorax must

be entirely suppressed by the bandage, and respiration performed by the diaphragm alone.

N. B. In this fracture the motions of the thorax being incessant, the reunion of the fracture without bandage is impossible; if you fail to apply the bandage, the motion of the bones will raise the inflammation to that height, that the patient will be suffocated by the general affection of the lungs, or by the effusion of matter round the broken bone, and the least misfortune that can happen is tedious suppurations under and around the broken parts of the sternum, and caries of the bone itself, so that it becomes necessary sometimes to apply the trepan. The bandage which we have directed, though drawn very firm, is far from oppressive, the patient feels it to be rather a relief; before the bandage is applied, the grating of the bones, the inflammation, high breathing, and terrible cough, are increasing every moment; but no sooner is the bandage drawn firm than the crepitation ceases, the pain is relieved, the cough and high breathing begin to abate, and by plentiful bleedings and opiates all comes right again, and the patient is saved.

5th, *Fractures of the ribs* are like those of the limbs, simple or compound, with or without injury of the surrounding flesh; and when there is injury of the adjacent parts, it is by the ribs being driven inwards so as to wound the lungs without any outward wound, such as make the inflammation dangerous.

If the fracture be simple, of one or more ribs, it is distinguished, and hardly distinguished, by a slight crepitation, the broken ribs being wrought backwards and forwards under the fingers, by the patient being sensible of the grating of the broken bones, and by the sharpness of the pain. There is little crepitation, because the ribs are so connected with each other by the intercostal ligaments and muscles, that they cannot be displaced; each rib serves as a splint to preserve the direction of the adjoining ribs. There is no occasion for setting the broken rib for any compress, nor for any particular bandage; but to prevent motion, the heavings of the thorax are to be suppressed by applying a table napkin firmly round the breast, as in figure 23, page 140, which, the firmer it is applied, gives the more perfect relief. This is all that is usually done; labourers and country men, with whom the accident is frequent, do no more, and seldom require advice.

When the rib has punctured the lungs, the air is effused, an emphysematous tumor is formed, crackling like a bladder half full of air. There is no possibi-

lity of mistaking the nature of the accident ; it may in general be disregarded, for inflammation round the broken bone soon closes the opening in the thorax, inflammation in the wounded part of the lungs prevents the farther effusion of air, the air already effused is absorbed, and the tumor disappears. But if the effusion of air continue, the whole body will be inflated, the air passing along in the cellular substance will inflate the scalp and eyes, and extends downwards to the thighs and private parts, till by its accumulation about the throat, it almost suffocates the patient. Small scarifications with the point of a bleeding lancet, are required to discharge the air, they may be made occasionally in various parts, they heal immediately. After the cellular substance is emptied of the air, the point where the broken rib is, should be pressed with a firm compress to assist the adhesion of the lacerated parts surrounding the fracture.

6th, *In fractures of the spine*, there is nothing that belongs to the surgeon's department, the case is purely radical, the spinal marrow is affected by the compression of the fractured bones, or injured by the concussion, just as the brain is affected by a blow on the head ; but it is a kind of injury much less accessible to the surgeon's hand. The spinal marrow is plainly compressed, the patient loses instantly the power of his lower extremities, which are cold, and without feeling, the bladder and rectum are paralytic ; the surgeon needs to order glysters daily, and to introduce the catheter. The parts on which the patient lies ulcerate first, and then, in spite of all possible care, fall into gangrene. Such are the symptoms, and such frequently the manner of our patient's death ; and notwithstanding the bloody operations described in books, of making incisions, finding the fractured or luxated bone, and drawing it out by the spines or splinters, there is nothing practicable, and those very ignorant directions given upon the highest authorities are dangerous to none but boys. The cutting into the fractured vertebra is a dream.

7th, *In fractures of the lower extremities*, there is no occasion for bandages, for the patient lying in bed, the part is in no danger of being moved. Unless you could invent a machine which could enable a patient to walk or stand upon his leg, you need none. In all fractures of the leg, then, simple as well as compound, you merely lay the limb out upon its pillow or splint ; nothing but convulsions, delirium, or mania, can endanger the fracture, or require bandaging. In laying a fractured leg, where but one bone is broken, you need be at no pains about the posture ; if the leg lie easy, and the patient complain of no pain, all must

be right ; but when both bones are broken, you must be at pains to trace the sharp line of the tibia with your finger, for that regulates the posture of the leg. This you cannot do at first, because the general swelling hides the bone, but you have no fear of altering the posture of the limb, and you know that the subsiding of the swelling marks the proper period for ascertaining the posture of the limb.

N. B. In fracture of the leg, and especially in compound fracture, you must be careful to preserve the right posture, for the limb is exceedingly apt to change its form from day to day, according to the place that the patient takes in his bed, and the posture of the limb with regard to that of the body. Two points you will especially attend to, first, The heel slipping over the end or side of the pillow, or, making by its prominence more impression upon the bed or pillow, falls downwards ; and when the bones are reunited, it is found that there is a slight deviation of the tibia from the straight line ; the bone appears a little prominent on the inside of the leg, while the foot is a little turned outwards, in a lame, or at least a weakly posture ; yet this degree of obliquity, though it causes a slight awkwardness, never causes a great deformity. Secondly, The strong muscles lying all on the back part of the leg, the fractured part is more apt to be bent in the opposite direction, so that the bones unite with an angle at the shin. This causes a grievous deformity, and worse than that, produces a shortening of the limb, and a halt in the gait almost as remarkable as that which arises from fracture of the neck of the thigh bone, and the point or angle where the tibia projects is apt to become a sore, for it is very easily fretted and ulcerated. This is especially to be guarded against, and is particularly apt to happen in compound fracture, where the limb being laid in a great case, is plastered and poulticed, so that the surgeon hardly allows himself to see how the bones lie, and has given such a formidable appearance to the disordered limb, that he is afraid to look at his own work, to clean the sore, or to move the leg. Two directions then may be useful ; first, Always to pad up the heel and foot properly, so as not to allow the heel to sink, or the foot to fall to one side ; secondly, To be careful always to prevent the leg taking an arched form with an angle at the middle of the tibia ; it is impossible to keep the foot too far forwards, or, in other words, an angle in which the middle of the tibia was depressed was never known to happen.

8th, *But why should a man lie with a broken leg when he can sit or even move ?* Indeed I know of no reason ; it is often proper that we should set our patient's leg so as to enable him to sit, were it no more than that he might receive his friends,

play cards with them in an evening, and linger through his confinement with as little tedium as may be ; it is sometimes necessary that a man should be wheeled in a great chair into his office or counting-room to do business ; it is sometimes absolutely necessary that he should be diverted and moved, for some men have, from so slight a matter as a fractured leg, fallen into incurable hypochondriacism.

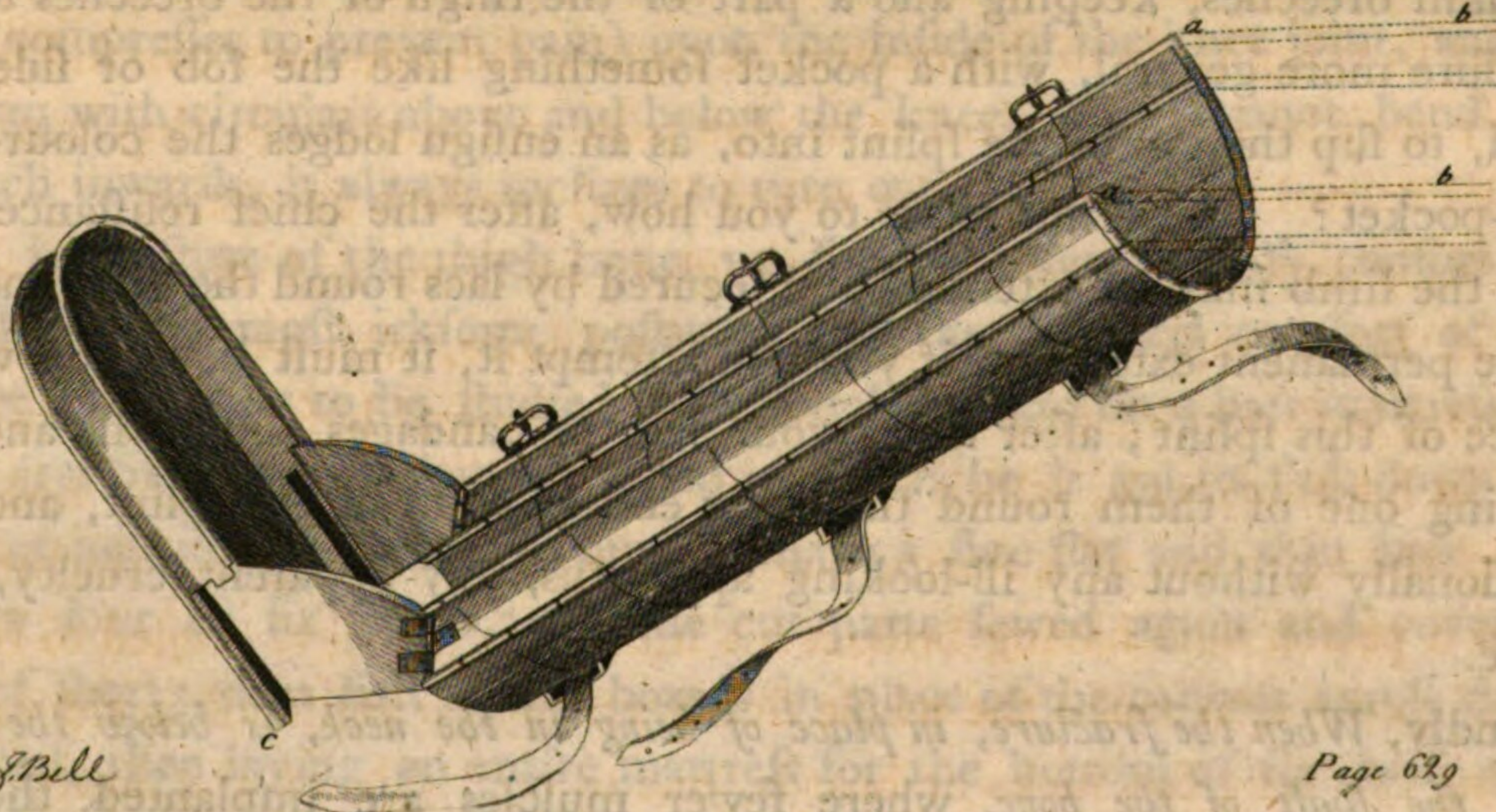
To accomplish this, the limb must be more regularly set, and then placed in a box. I do not think rollers or compresses necessary, and yet they may be used, for since they are not used with the design of shaping and regulating the callus, but merely of steadying the limb, keeping it soft, and filling up the hollows betwixt the limb and its box, there can be no danger of their being drawn too firm, yet the rolling with rollers, &c. moves the limb too much.

The process I follow is this : The limb having lain on its pillow for eight or ten days, and the swelling being gone off, I lay an eighteen-tailed bandage, made of fine linen, upon the pillow, and lap the tails of the bandage gently round the limb, and the linen being old and worn, makes the limb feel cool, soft, and pleasant ; next over that, to increase the thickness, I lap the tails of an eighteen-tailed bandage, made of fine soft flannel, which, were it applied next the skin, might cause itching and heat. The limb being now softly padded, as it were, with those bandages, is to be laid on a long and firm pasteboard splint, another splint is to be laid above it, in each splint a hole is to be cut for the respective ancles to which they are applied, and the two splints, extending each of them beyond the knee and ancle, are to be bound very firmly with the several tapes over the foot, ancle, calf of the leg, under the knee, and above the knee ; and it is worth observing, that in tying tapes in this manner at regular distances over two stiff splints, though they may be bound so firm as to give pain and uneasiness, they can never (like a roller turned firmly round the naked limb) produce gangrene.

When this is done, the limb is firm enough to be lifted and moved freely in bed ; and if, for example, it were the limb of a soldier, who were to be conveyed away along with a retreating army, or sent to a general hospital ; or of a sailor, who lying in his hammock, which is a very narrow and inconvenient bed, perhaps during the agitation of a storm, were in danger of having his fracture deranged ; or a person who having broken his limb on a journey, needed to be carried home ; you might make the whole steady enough to resist all accidents, by just applying two long flat sticks or boards, one to each side of the limb, above the pasteboard splints, binding them firmly like a second set of stronger splints,

long enough to pass the heel and the knee. Of course, such splints must be applied in the extended position of the limb.

But for a person, especially in genteel circumstances, who merely wishes to sit up and be amused, a neat small box should be prepared, with a long and firm board, a little hollowed or cushioned, to lay the leg upon, a foot-board to rest the foot upon, moving by a hinge, and occasionally raised or depressed, to change the posture of the foot and relieve the ankle; the sides of the box should be made with hinges, so as to open and close, and somewhat concave, or composed of thin wood pasted on leather, and then split with a knife, so as to bend round the limb and enclose it firmly. With this box, neatly applied round the limb above the splints, the patient can be in no danger from any ordinary degree of freedom. In order to give some specific idea of the manner of fashioning this box, and yet to leave some degree of latitude to the ingenuity of the surgeon, I give a sketch of one very old; it is the machine of Guillemeau, the pupil and favourite apprentice of Paræus. Such a machine, with a hinge at the knee, (a) a board to go upwards a little way under the thigh, (b) and with wheels under the heel or angle of it, (c) so as to make it run smoothly along the floor, may be easily contrived. In the military service, or at sea, the carpenters will, with a few nails and leather, put boards together, so as to make a very safe and commodious case. For a person of rank, such a box may be nicely wrought by a joiner while the first inflammation and swelling of the limb are subsiding; and perhaps one or two such machines, neatly made of wainscot, should be kept in every infirmary.



9th, But in fracture of the thigh, there is no possibility of rising, nor indeed of

having any relief, but by that flight change of posture which can be accomplished by moving the body, while the thigh itself is kept as steady as possible upon its pillow. Whatever degree of confusion you may have felt upon reading a history of the various machines, will be easily removed by a few simple directions.

First, *When the neck of the thigh bone is broken near its trochanter*, you would not leave the cure entirely to Nature, you would not willingly believe that you can do absolutely nothing for your patient or friend. When you extend the limb, and find that you have so far replaced the broken bone, that you begin to feel the crepitation, you cannot but wish to retain it in that place, and you lay large and firm compresses upon the trochanter, the rising of which marks the shortening of the limb, and the fixing of which would prevent that shortening. These compresses should be pressed very firm by a spica bandage rolled round the hip, as it is in page 137. fig. 22. round the shoulder. The long splint of Duverney must next be prepared of sufficient length to reach some way up the side, made of firm deal board, declining gradually in size, in proportion as the member naturally diminishes in size, covered well with flannel, that the patient may feel no hardness. There must be put round the pelvis a very firm bandage like the topband of a pair of buckskin breeches; and into a slit in this bandage must be fitted the top of the splint. The resistance which is to elongate the limb is to be accomplished by the pressure of the top of the splint against this circular, and therefore the circular must be prevented from being pushed upwards by a strap going round under the pelvis like that of T bandage; or why should we not actually take the topband of a pair of buckskin breeches, keeping also a part of the thigh of the breeches to make the pressure more general, with a pocket something like the fob or side-pocket inverted, to slip the top of the splint into, as an ensign lodges the colour-staff in his side-pocket? I need not relate to you how, after the chief resistance is established, the limb may be extended and secured by lacs round the knee and ankle; as to the permanent extension, if you will attempt it, it must be easier with the assistance of this splint; after fixing your lacs or bandages round the ankle, you may bring one of them round the lower end or point of the splint, and extend it occasionally without any ill-looking apparatus, any apparent cruelty, or real violence.

Secondly, *When the fracture, in place of being in the neck, is below the trochanters in the shaft of the bone*, where fewer muscles are implanted, the retraction is less powerful, but still there is retraction, and the shortening of the limb

must be resisted by the long splint of Duverney alone ; it is not a torturing machine, does not grasp the limb at particular points, but lodges the whole limb, and gives friction and resistance at every point.

Thirdly, *When the thigh bone is fractured in the middle*, there is no reason, even in the most muscular man, to fear retraction, and the thigh may with all possible propriety and safety be laid smoothly out upon a pillow, being careful of the posture of the body that it be not higher than the thigh, so as to gravitate downwards upon it ; the thigh should be laid on one side, should be laid a little out from the body, and a little higher (indeed the body naturally sinks into the bed), and the surgeon should also be careful of the posture of the heel and foot, for the leg is apt, by its weight and wrong inclination, to turn the thigh upon its axis.

Fourthly, *In fracture of the very lowest part of the thigh bone, in the part adjoining to the condyles or lower head of the bone*, the fracture is apt to be very oblique ; and sometimes it happens that the bone is fractured so very obliquely, that the effect is the same as if one of the condyles only were broken away †. In this oblique fracture there is indeed no forcible retraction of the bone, but a continual tendency to obliquity. Very often I have seen such a fracture so ill cured, that there has been a shortening and weakness in consequence of the in-kneed posture of the limb, which was both very distressing, and a very great deformity. Then, although there is no occasion in this fracture for any powerful machine, there is a necessity for the perpetual resistance of a very strong splint. The leg turns outwards, the splint of firm fir board, &c. is therefore to be applied (with proper compresses to prevent pain) upon the inside of the knee joint, and bound very firm with circulars above and below the knee. You cannot bend the leg too much inwards, it always inclines to turn out.

N. B. In fracture of the thigh bone, we foresee a very uneasy confinement of six weeks to the most irksome postures, and the ease and comfort of our patient are principally to be studied. He should be laid on a hair mattress, which is cool and firm, rather than on a bed in which he is apt to sink down ; and it will be of infinite advantage to him to have a fine flat and thin hair mattress cut into four or six pieces, and the cut parts sewed again and covered with pieces of sheet ; then first laying boards in place of the canvass across the frame of the bed, then laying an entire mattress for the bottom of the bed, and then laying the several pieces of the cut mattress according to your pleasure, you

† *Vide* No. 10. of the plans at the top of the chapter.

can raise or depress any part of the body to any degree, and alter your patient's posture with the least possible motion. If any other pillows be required, they should be the firm and flat hair cushions like those of a couch, and indeed the best bed is a couch, which friends and attendants can go round about in all directions, which can be wheeled to the window or towards the fire without discomposing the fracture, and which should be placed in some public room, where the patient will have as little as possible of the feelings of a sickbed.

You must have a hand-rope for the patient to raise and move himself by without any strain of the limbs or body, urinals and bed-pans for his convenience, and he must have occasionally anodynes to abate the irritation of his confinement and distressing posture, and laxatives of castor oil, cream of tartar, lenitive electuary, sulphur, or whatever suits his constitution, to prevent the constipation which proceeds from opiates and confinement.

10th, *In compound luxation of the tibia and fibula*, in that where the bones are broken, the joint burst up, the heads of the bones turned out through the wound; the astragalus and heads of the tibia or of the fibula almost separated, there is such destruction and laceration of parts, that we are doubtful whether to attempt preserving the foot, we can do little more than lay the limb on the sound side, and keep the foot as nearly as possible in its natural and proper direction. I have sometimes seen the ancle joint wonderfully distorted from being fractured and dislocated, even without that laceration of the skin which constitutes the case a compound fracture; and by drawing upon the foot very gradually, but powerfully, and working and modelling the disordered joint in the hand, I have restored it to its right shape, have set it with a firm splint well covered with flannel, &c. and bound pretty firm with a figure of 8 roller round the foot and ancle.

N. B. In this fracture still the tendency of the foot is to turn outwards, and you have to lay your splint along the inner side of the ancle joint, making a small window or opening in your splint to receive the projection of the inner ancle. By the resistance of this splint you draw the foot, which is inclined to turn outwards in a splay-foot posture, inwards into a natural one. It is the process of the fibula that guards the ancle on the outside, and keeps the foot right; and it is the fracture of the fibula, and the yielding of the outer ancle, that makes the foot fall off towards that side.

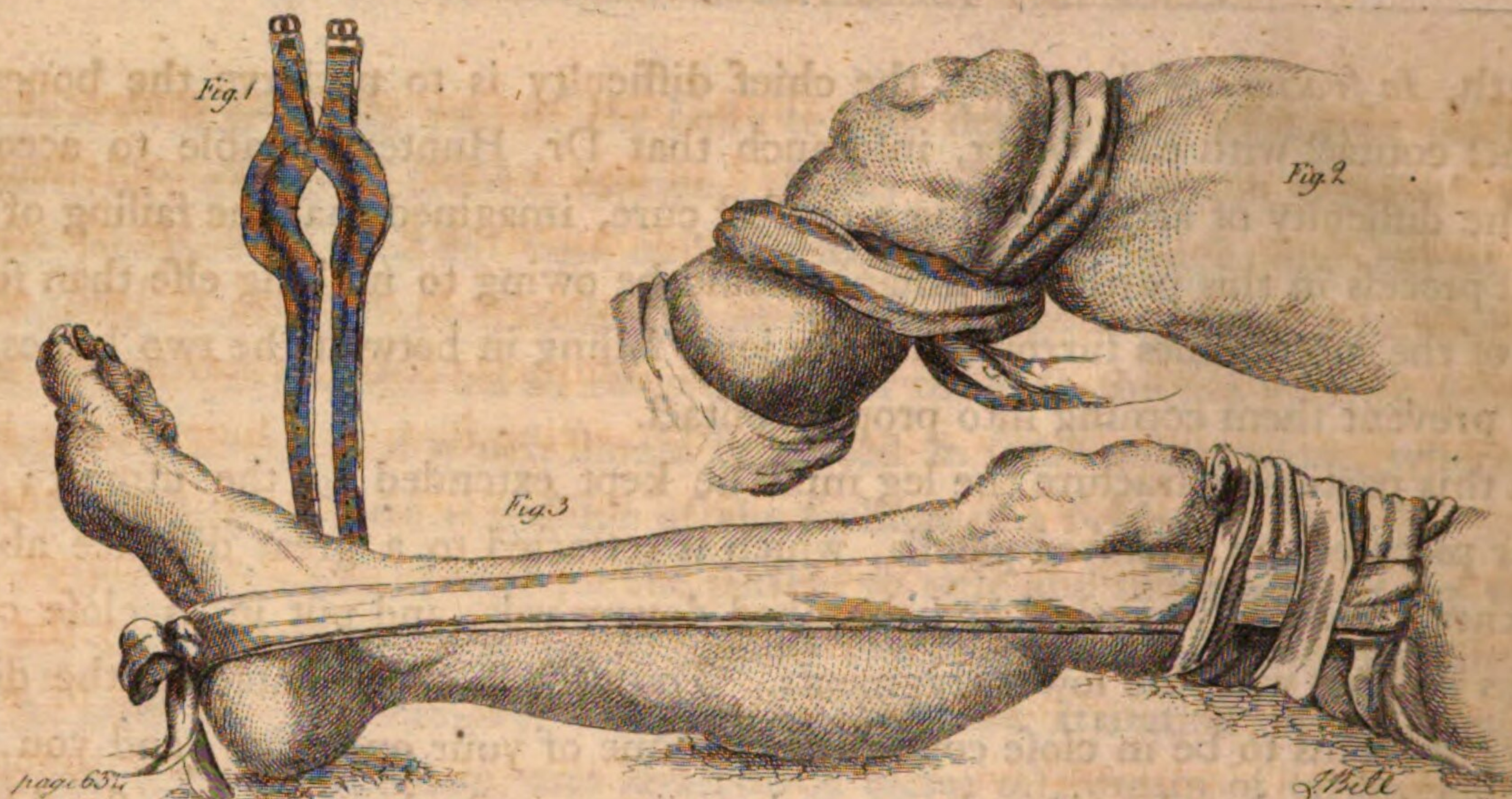
I mention this luxation here, because it is the only luxation where the head of the bone being replaced does not remain, it is the only luxation that needs to be bandaged as a fracture.

11th, *In fracture of the patella*, the chief difficulty is to preserve the bones in perfect contact with each other, inasmuch that Dr. Hunter, unable to account for the difficulty of accomplishing a perfect cure, imagined that the failing of the usual process in this particular instance could be owing to nothing else than some part of the membranes surrounding the joint falling in betwixt the two bones, so as to prevent them coming into proper contact.

In this particular fracture the leg must be kept extended to the utmost; the upper piece of the fractured patella, which is retracted to a great distance above the knee, must be smoothed and thumbed downwards, and put in as close contact as possible with the lower fragments. To put it in close contact is the difficulty; it seems to be in close contact at the time of your operation, and you are only convinced that the pieces have not been in contact when the cure should be complete; for when the swelling has subsided, when the patient begins to walk, a hollow is seen betwixt the two ends of the bone, and a ligament of some length is felt uniting them. The patient losing the pulley-like projection of the patella or rotula (and the extensor muscle being shortened), is never able to stand on one leg, never able to bear up the body on that limb, never able to mount a stair without carrying that leg before, and is never out of danger of forgetting himself, trusting the weight of the body upon that limb, falling backwards, and so breaking the other patella, or snapping the same one a second time, as I have seen happen very often.

To preserve the bones in absolute contact, and prevent this imperfection in the cure, is almost impossible. The swelling, before you are called, is so great, that in many cases bandage cannot be applied for six or eight days. When the swelling is gone, the pieces of the bone cannot be made to approach each other, nor can the bandage, from the remains of the general puffy swelling, be applied close to the bones. The bandaging has been attempted in various ways. The common bandage is a belt of leather split like the common leather retractors, with a small opening in the middle of the slit (a, figure 1st) for receiving the patella; each of the sides or semicircles of this opening is padded up with leather (b b), so as to make a pretty firm compress of a circular form; and when the bandage is buckled round the knee, and drawn firm, the two sides of the slit are of course drawn so close together, as to press the two pieces of the patella betwixt them.

If you are in the country, where no such bandage is to be procured, you may,



with fully as good effect, bind the broken patella in the following manner: First, If you have to carry your patients any length of way, I do not know of a better bandage than a hand towel, or something nearly as thick, put round the knee thus like a figure of 8; nor indeed can any thing perhaps be preferable as a permanent bandage. Having carried your patient home, and laid him in bed, you first take a thick, flat, and very long shaped compress, which is to serve as both compress and bandage, and which of course must be a yard and a half in length; you lay the middle of this compress over the upper or ascending part of the patella, and you press it down upon the patella with both hands; you then bring it round the thigh above the knee joint, then cross it behind under the ham (as in figure 2d), then cross it again upon the fore part of the knee, and then secure it. The second part of your operation is performed thus: You take a very long and firm linen roller in your hand, you proceed to thumb down the patella into the closest contact possible with the lowest piece, perhaps you put another compress over the upper broken piece, and your roller being a two-headed one, you take one head of the roller in each hand, you press the middle of it firmly down upon the compress, then your assistant presses the thumbs of both hands upon the upper piece of the patella, with the design of pushing it very close down, and when he has pushed it as low as possible, you make your first turn of the roller under and behind the ham, to secure what he has gained, and you continue at your own discretion turning your double-headed roller in figure of 8 round the joint as long as you think you are gaining any thing in respect either of closeness or security.

But I have often been inclined to think, that the thicker our compresses and bandages are, the more are they inclined to slip, as, for example, in reducing a luxation, where the lacs and bandages put about the leg or arm are so clumsy that they cannot but slip. Perhaps then it would be as well, if, instead of this clumsy compress, we were to take a smaller compress of about three fingers broad, and not quite the length of a finger, and connecting it with a short roller like a tourniquet compress, apply it over the upper or retracting part of the patella, and secure its place by pinning the roller, just as you do that of the tourniquet compress. Next, it would be well to take a broad two-headed roller, lay the middle of it over the compress, and make one or two turns in figure of 8, depressing the patella, and ascertaining its posture still further, but without putting any clumsy thickness of bandage round the limb. Then (the part being in some degree steadied) I would take two bandages of an ell long, and lay them along, one along the inside, the other along the outside of the limb, the one end of each band is laid up along the thigh, and the other down along the leg; I would then begin the application of that roller, by which I meant to secure the upper part of the bone, I would take a thin, but very firm linen roller, single-headed, and several yards long; I would turn it round and round the lower part of the thigh, just above the joint, immediately above the bone, so as to take a firm hold of the bone above the condyles, embracing the longitudinal bandage at the same time, and this roller should not be very broad, less than a hand-breadth. This circular roller being thus applied, and having a firmer hold of the patella, and being so tight, that upon pulling it down, the patella will be pulled down, you turn down the upper end of the longitudinal roller, or that which lies up along the thigh; and the longitudinal roller lying thus under the circular one, embraced by each turn of it, when you pull upon the longitudinal bands, you draw down the circular bandage, and thus depress the upper broken piece of the patella, till it almost meets and touches the lower piece; and as there are two longitudinal bandages under the circular (one on each side), you may carry the two longitudinal bandages under the sole of the foot and tie them together. To give a more complete pull upon the patella, you might, if you pleased, lay under the turns of the roller a third longitudinal bandage exactly in the middle, which being tied like a stirrup under the ball of the great toe, would perfectly preserve the extended posture of the limb †.

† This manner of bandaging is explained in figure 3d.

N. B. Before applying these rollers, they should be all soaked and wetted (best in spirits) to make them stick closer to the flesh, and if (having applied them) you are perfectly satisfied with their operation, you may easily convert them into a firm case, by taking a glue-pot and soaking them with glue, so that each turn of your roller would stick to another, and the whole to the flesh, the knee being thus enclosed in a very perfect case. Both during the cure and for some time after the patient begins to walk about, I find it convenient and safe to stiffen the joint, by laying a strong splint behind the ham, lest the patient should make a false step, and the knee yield before the ligament joining the bones were become strong.

N. B. Though I prefer simple and moist rollers, which stick thus close to the parts, yet there is no doubt that the clumsy compress-like roller contorted round the knee in the form of figure of 8, has sometimes succeeded remarkably well. In proof of this, remember what Meibomius reports of a cow-herd, who having broken his knee pan, made a very perfect cure by twisting round it a firm straw-rope.

12th, *In fracture of the Olecranon* (which is another exception to the general rule of keeping a fractured limb gently and pleasantly bent), you must keep the arm completely extended, for the triceps muscle pulls up the olecranon to an incredible degree, it mounts absolutely half way up the arm, and although you thumb it down again, yet if you keep the fore arm in any degree bent, the interstice betwixt the end of the ulna and its broken process will be filled up with bone, and the fore arm be so far anchylosed, that the patient will never be able to extend it, for this filling up of the interstice will be just equivalent to the lengthening of the ulna.

In setting this fracture, you thumb down the retracted olecranon, which is broken away from the end of the ulna, and you completely extend the forearm so as to make the end of the ulna meet its broken process, you cover the broken process with a compress, and fix it with a double-headed roller, turned in form of figure of 8 (as in bleeding), making occasionally turns purely circular round the broken part, and you make all sure by laying a stiff splint in the bend of the arm, and fixing it with a second roller in order to prevent the arm being thoughtlessly bended: indeed, nothing in such cases should be trusted to the discretion of the patient.

N. B. In this fracture there is abundance of callus: there is no danger of that imperfect and ligamentous union which takes place in the broken patella, nor

is there any danger of that profusion of callus, running like molten lead, into the cavity of the elbow joint, which was supposed to happen, and to occasion ankylosis. When this fracture has been neglected or ill set, the fore arm kept at right angles with the arm, and the person lamed perhaps in his right arm, it has been proposed to make incision to cut out the intermediate callus, with the design of setting the bones properly with the arm extended; an operation which is surely not impracticable.

13th, *The rupture of the Tendo-Achillis, or great back tendon of the leg*, more justly ranks with fractures than with lacerations; for while it was considered as a laceration of a soft part, it was actually the practice of surgeons to sew the ends of the tendon together with great embowelling needles; but now being ranked with fractures of the bones, it is set like a broken bone, like the fracture of the patella, for example, and the surgeon has no care but merely to smooth down the muscle, to prevent the retraction of the tendon, to preserve the ruptured parts as nearly as possible in contact with each other.

The tendo-achillis is broken as the patella is, not by a blow or fall, but by a sudden and violent exertion of its own muscles, in consequence of making a false step, the patient being instinctively incited to make an exertion too sudden and violent for the tendon to withstand it; an exertion which sometimes, in place of tearing the tendon, breaks the heel bone. When the tendon is broken, the patient, from its insensibility, feels no pain, he feels as if he had been struck a smart blow with a stick; it commonly happens, in dancing, or in making a false step, as in slipping, though not unfrequently it happens when walking apparently securely on even ground; the patient instantly falls down lame, the shortening of the bellies of the gastrocnemii muscles, the retraction of the tendon, and the interstice between the two ends of it are perceptible, and the patient himself is conscious he has broken the tendon.

For setting this ruptured tendon, various machines have been invented, and especially various shoes with straps and buckles behind to draw up the heel, while the upper part of the tendon, on the other hand, is pressed downwards. According to my experience, this extension of the toe and drawing up of the heel are unnecessary, the foot may be safely left in its natural posture; it is chiefly important to prevent the slightest contraction of the gastrocnemii muscles; for this purpose, the calf of the leg should be smoothed downwards with the hands, the whole of the calf of the leg from the ham downwards must be rolled with a firm

roller, proceeding from above, but the bandage should not pass the biggest part of the calf, nor at all approach the ruptured part, nor even the inflammation and swelling which surrounds it.

N. B. The chief danger in rolling the leg in rupture of the Tendo-Achillis, consists in approaching the part actually fractured. I was once called to a gentleman whose whole leg from ham to heel was firmly bandaged with a roller, the turns of which made deep impressions on the swelled ankle; and at the point where the tendon was actually ruptured, the turns of the roller (so firmly was it drawn) had sunk down very deep indeed betwixt the ends of the tendon, they were thus separated to a great distance from each other, there was no possibility of their uniting, and had they been left so, the old gentleman must have continued perfectly lame. It was on the fourth day after the accident that I was called and undid this bandage, yet the cure was in the end tolerably perfect. The muscle should be well rubbed and smoothed down, and neatly rolled, the ankle and cellular substance surrounding the ruptured part should be left perfectly free, the foot should be steadied, but kept quite on the level, the toe neither pointed downwards nor upwards, but the foot kept at right angles with the leg. Mr. Robbard surgeon (I believe) at Ipswich, was so bold and so honest, as to make the experiment first on his own person, of just tying down the gastrocnemii firmly, but still continuing to walk about all the while the tendon was reuniting. This I dare no more approve of than the firm bandaging of the ruptured parts.

The tendon is generally a little knotty, especially when first united; sometimes it adheres so to the surrounding parts, as to make the joint stiff; and always the tendon is a little lengthened, and the muscles of the calf somewhat contracted, so that the calf of the leg seems to have shrunk upwards towards the ham.

CONCLUSION.

In this section, consisting altogether of rules, which should be perfectly minute, I fear there must be many omissions which I shall hardly be able to compensate for in the following general observations.

First, It is uncomfortable for the young surgeon not to know at what period he may venture to undo the apparatus in any particular fracture; for this reason, though there can be no specific nor absolute rule, yet surgeons have been at pains to mark the period in which they suppose each individual fracture to be healed.

Without warranting the propriety of these rules, allow me to mention, that authors say, the smaller bones, as the Clavicle, the Ribs, the Fibula, are cureable in twenty days; the bones of the Cubitus or Fore Arm, the Radius or Ulna, are cureable in thirty days; the fractures of the Shoulder Bone or Thigh Bone require fifty days to reunite; though, to be perfectly reunited and strong, the fractured Thigh Bone requires seventy days. But rules so specific as these, mentioning the very day on which a fracture may be supposed to be cured, cannot be useful without being understood. Allow me then to observe, that as it appears to me the process is either slower and more imperfect in children, or at least, in children the bone is more apt to be broken again: We cannot indeed wonder at callus being slowly formed, since the bones themselves are still incomplete and growing for two-and-twenty years: In fractures then happening in children, you keep the roller and pasteboard splint longer applied. Nor is it from the slow formation of callus that the cure is delayed in fractures of the great bones; the process is not slow in proportion to the greater mass of bone that is to be formed! perhaps a callus will form as rapidly round the bone of an ox as round that of a boy, and be as speedily completed in fracture of the thigh bone, as in fracture of the radius, for every part has vessels proportioned to the mass of callus that is to be formed; but the cure is slow in proportion to the size of the bone, from the larger bone having to support a greater weight; or rather the mass of callus is slow in acquiring firmness proportioned to its size, or to the weight it has to bear. It is for this reason that we are cautious of trusting the weight of the body too early on a broken limb; in fracture of the humerus, as the arm hangs and does not necessarily carry any weight, the patient may leave off his splints in six weeks; but in fracture of the thigh bone, which has to bear the whole weight of the body, we dare not expose the unconfirmed callus under such pressure, till fully three months have elapsed.

Allow me also to observe, that on particular occasions, particular precautions must be taken; that while a man is in his sound health and reason, no bandage nor splint is required in fractures of the lower extremity; but that when a man is maniacal or delirious, besides the ordinary precautions of splints, the limb, after being set, must be laid betwixt two pillows, tied to them, and the pillows in their turn fastened to the bed; that when a man has to be carried far with a fractured limb, besides being regularly bandaged with splints, there should be laid along the sides of the limb, above the splints, long and firm pieces of wood band-

aged like the splints, and extending beyond the heel to prevent accidents. And finally, that in the sea service, and in the army, when either an army is to retreat, or an hospital to be moved, or when a storm is expected at sea, the surgeon should be as carefully advertised of the approaching storm, or of the present movement of the army, as any higher officer, for he has many precautions to take for the safety and comfort of his men.

The surgeon when he wishes to make any part or bandage particularly secure, has it in his power to convert his rollers into a firm case, either by soaking the bandages in whites of eggs, which soon hardens in a very firm varnish; or with the whites of eggs may be mixed a little flour and sugar to make it into a paste, or he may apply any common varnish over his bandages, as white spirit varnish, but that is slow of fixing, and is very thin, or he may strew a little powdered rosin on his bandages before they are applied, and then by soaking the bandages with spirits of wine, the rosin is dissolved, and the whole adheres to the limb with very singular firmness; or finally, the bandages may be soaked with fine and well made glue, which makes a very firm case, and is very far from being offensive.

These methods are all of them more cleanly, less cumbersome, and indeed I think more effectual than the old Arabian method of bedding a fractured limb in stucco or Paris plaster.

Lastly, I would observe, that though in a fracture of the leg or thigh bone, or of the patella, splints are quite unnecessary during the cure, yet when the patient rises from bed, rests the weight of the body on the fractured bone, and begins to be exposed to accidents, light but firm splints should be laid alongside of the limb; while he wears those splints he is in a manner under your controul, will walk with restraint, and be careful of using dangerous freedoms with the limb, and thus he may be saved from a second confinement more terrible than the first, as it is incurred by precipitation and rashness.

RULES FOR COMPOUND FRACTURE.



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J. Bell

Perhaps there is no sight more shocking, or that more particularly impresses us with the idea of irremediable destruction, than what we call a compound fracture; a mangled limb with the bone protruding some inches, the wound through which it protrudes lacerated and ragged, the surrounding skin black and livid with ecchymosis or extravasated blood; the whole limb swelled enormously, even in the course of a single hour; and the patient with his mouth parched, his eyes heavy, and his head confused, he is, indeed, often delirious with fear and suffering. But the surgeon dilates the wound a little with his bistoury, reduces the bone, composes the limb, and brings the integuments close, so that what seemed a terrible laceration, appears to be but a wound of very moderate length. The limb which was before so distorted, that the foot lay altogether on one side, lies now right and even; the blood which was streaming from the limb or caked about it, is now cleaned away, and a piece of clean lint laid upon the wound, and though such a case is never without danger, the assistants and friends are sensible that a situation apparently very desperate (and certainly fatal without help), is soon converted, by the care of the surgeon, into a state of hope and expectation.

You will easily perceive, that in an injury varying so much in its circumstances, there must be an infinite number of nice and curious operations to perform, of stretching the limb, dilating the wound, reducing the protruded bone, and taking away the splinters, stopping the hæmorrhagy, and laying the lips of the wound in contact; and you will naturally imagine, that where there are such complicated injuries, such laceration of the soft parts to heal, and so much bone to be reproduced, the suppurations will be often very profuse and the cure long delayed; and that during such tedious cure, you must have much to do for your

patient, to moderate the suppurations, and to preserve his health. It shall be my business to represent in regular order, the state of the patient, and the various duties of the surgeon, from the first moment of this dismal accident.

What strikes you upon first seeing your patient is, along with the horrible disorder of the limb, his febrile state and disorder of mind. For as the limb swells in a few hours, the fever named Symptomatic fever rises; you observe the tongue parched, the lips black and dry, the breathing oppressed and anxious, the eye heavy and blood-shot, the pulse is thumping, and the head is confused; the patient is not unfrequently delirious, and the fever and delirium often continue for eight or ten days. Nor is this disorder a mere consequence of the wound, great as it is, for you will observe by the wild countenance of the patient; that there is as much disorder of the mind as of the body; perhaps, he has, upon the cry of fire, awoke from sleep, and thrown himself in the utmost terror from a window, his limbs are terribly shattered, and when he recovers the use of his senses, he finds himself carried by persons unknown to him through the confusion of a midnight mob; what recollections of friends left in circumstances of danger must then rush upon his mind, it is needless to mention. This general shock then to the bodily frame and to the senses, is succeeded by coldness, shivering, trembling, and confusion of mind; the delirium sometimes begins from the very first moment of the accident. This shivering marks the commencement of the fever; this previous state of coldness requires that the patient should be laid in a warm bed, that warm flannels should be applied, that he should have a little warm wine or other cordial, that he should have a dose of laudanum. If the patient is to be bled, it is only when the pulse, at first trembling, becomes full and thumping, when the face flushes, and the eyes become inflamed; in short, during the first trembling and disorder the patient must be comforted by cordials, it is only after some hours that he can be safely bled, though the vulgar after every accident are in haste to bleed.

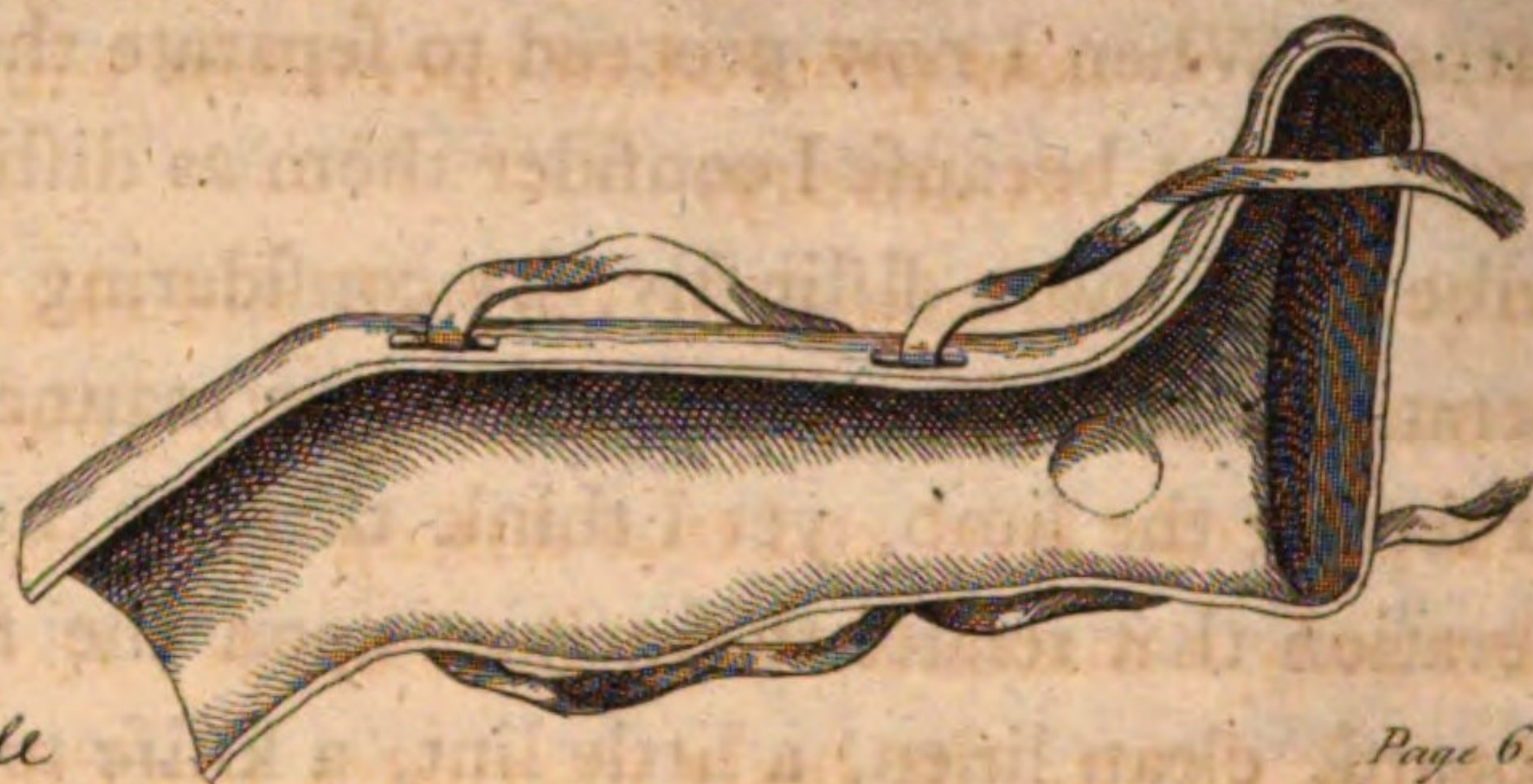
OF CARRYING THE PATIENT.

Your first care is to have your patient carried with as little injury as possible, and if you have but a little dexterity and recollection, he can be carried with none; for unless it be a soldier who has his thigh bone broken in the field, and who is carried off by his companions in their arms, or a sailor whose leg is broken by shot, splinters, or the recoil of guns, and must be carried down a

succession of gangways by the boatswain's crew, every person having a fractured limb may be carried without injury. Now, I will venture to say, that however excellent the machines which have been, or may be invented, as by La Faye in the Memoirs of Surgery, or by Mr. Wathen, *vide* page 596, will never be at hand, and though they were, it is fit the surgeon should know how to use the most ordinary apparatus. When I now proceed to separate the several little operations of the surgeon, it is not because I consider them as distinct operations, but that I expect to describe them more distinctly, by considering them as successive steps of one great operation; and though I describe the manner of conveying the patient before that of setting the limb, yet I think there is no apology for not performing every operation that relates to fracture upon the spot, since nothing is required but pasteboard, clean linen, a little lint, a knife to make any dilatation of the wound that may be necessary, and the fingers alone are best for hooking out and disengaging the loose bones.

The moment you arrive at the place where your patient lies, you must proceed to extend the foot, while your assistants hold the limb, and by pulling firmly, steadily, and, remember, very strongly (for in this case a good deal of extension is required), you get the bone to go back within the integuments, and though perhaps you do not get the bone and the edges of the wound arranged exactly to your mind, you get the foot restored to a right direction with regard to the leg, the bone tolerably covered by the integuments, the patient relieved in some degree from the pain of this protrusion, and the whole member put in such a posture that you can lay it on a splint as a safeguard. There are two forms in which the compound fracture usually presents itself, first, when the patient having leaped or fallen from a height, the bone is merely broken, and protruded perhaps to the length of some inches, then the foot being extended and the bone reduced, you, after laying scraped lint upon the wound (which presently cakes with the blood), lay it upon a stiff splint made of fir board properly covered and padded with cloths, to which the limb being fixed by broad circulars of any common ribband gently tied, and with proper folded compresses put for softness under each of those circulars, the whole becomes pretty firm, and can be carried with safety; but if the fracture have been produced by the crushing of machinery, or by a loaded waggon passing over the limb, the bones are so crushed and destroyed, and the whole limb so reduced to a mass, that you should rather, after applying small cushions of lint to the lacerated wounds, lodge the disordered limb

in a case, and for this purpose the surgeon should be provided either with large tin cases lined with cloth or leather, or should have by him some of those conductors of Wathen, which are made of bend leather exceedingly hard glazed and varnished, in the shape of a large boot, cut perpendicularly through the middle, and large enough to lodge a swelled and disordered limb.



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The limb being laid on a firm splint, or in such a case as is here represented, the patient is then to be laid on a mattress, which may be placed upon a window-board, a door, a ladder, &c. for these are commonly used by the country people on such occasions. It has been the fate of several men of our profession to have their limbs thus fractured. Pott is not particular in mentioning the manner in which he had himself conveyed to town when his leg was fractured; but Paræus relates the misfortune which happened to himself with all the interest natural to the occasion, and with the unscrupulous and tedious minuteness of the old style. He was called, with two other physicians, to visit a patient not far from Paris, but they had to cross the Seine, and Paree wanting his horse to go into the boat, struck it on the crupper, when immediately the animal lashed out behind, and broke both the bones of his leg, when, partly from the agony, partly to avoid a second blow, he tumbled forwards into the boat, his leg bent under him, the bones protruded, and in this condition, and with a degree of pain which you almost feel when you read his description, was carried to the further side of the river to have his limb set. The description of his sufferings when he was carried from the boat is animated. "This pain was more dreadful, says Paree, than that which I suffered in the boat; one carried me, another sustained the leg, a third held the foot, one carried high, another carried low, one made his step to the right side, another to the left, but at last they brought me to my bed, and laid me down there to take my breath, and wipe off the sweat that distilled from every pore of my body †." These are the miseries of being carried in men's arms with

† "Soudain fus porté dans le batteau, pour passer de l'autre part, pour me faire penser : mais le bran-

a broken limb not fixed upon a splint. Indeed I need hardly have quoted Paræus to explain what any man of sensibility can easily imagine.

Perhaps you have at first only turned down the stocking, or cut the breeches, but the patient being now brought to his own home, you proceed to perform your operations more regularly. You have had your patient conveyed along with all possible tenderness, but you now proceed to operations which require a degree of harshness, and even of apparent cruelty.

First, You prepare the bed, by lifting the mattress and clothes, and in place of the laced canvas bottom, you lay boards across the bed-frame, which makes the bed hard, and keeps it perfectly level and true during the cure. You next, in place of the feather-bed, lay only a mattress above the boards; for a feather-bed permitting the patient to sink down, the body gravitates towards the fractured leg, so as often to make the bones overshoot each other with a dangerous shortening of the limb. You next cut another mattress into four pieces, and round each piece you sew a piece of sheet; these are laid over the first mattress, and shifted under the patient from time to time. You then lay a pillow for receiving the limb; and having laid your patient on this bed or couch, you proceed to cut off the breeches, stockings, &c.

OF REDUCING THE PROTRUDED BONE.

The first and most important point of practice I have to teach you is, how to reduce the bone; and to instruct you, I must be careful to represent the several possible conditions of the parts. Let us first suppose then, that the patient has thrown himself from a window on the cry of fire, or let us suppose that he had a simple fracture, had become delirious, had been carelessly watched, and had risen from his bed, and stalked furiously about the room with the fractured bone driven through the flesh, and stamping upon the ground; then the tibia

slement d'iceluy me cuida faire mourir, pource que l'extremité des os rompus frayoit contre la chair, et ceux qui me portoient n'y pouvoient donner ordre. Estant hors, fus porté en une maison du village, avec plus grande douleur qui je n'avois enduré au bateau: car l'un me tenoit le corps, l'autre la jambe, l'autre le pied: et en cheminant l'un haussait à fenestre, l'autre baissait à dextre. Enfin toutesfois on me posa sur un liét pour reprendre un peu mon haleine, où pendant que mon appareil se faisoit, je me fis essuyer tout le corps, pource que j'estois en sueur universelle: et si on m'eust jetté en l'eau, je n'eusse esté plus mouillé."

protrudes through a very narrow opening, the foot is turned entirely over to one side, the bone is as if strangled by the flesh; it is difficult to extend the limb so as to get the bone to go back again through the skin, but it is possible, and you try it in the following manner: You lay the whole limb quite flat, you make two strong assistants with both their hands grasp the leg very firmly below the knee, you then grasp the foot firmly over the tarsus and behind the heel with both your hands, and begin to pull gently, steadily, and very powerfully, turning the foot a little from side to side; you also twist a hand-towel round the ankle, and take the assistance of it to give you a firmer hold on the foot, and to make you pull more steadily and equally. But if the bone will not go back, you must give the foot to another surgeon or assistant, and clasp your own hands round the broken part, and with your thumbs, without much reserve or affectation of delicacy, force in the bone, which, though it needs this force to reduce it, yet lies easy when it is reduced.

N. B. The ancients not only used pulleys and hand-ropes for this purpose, which we strictly forbid (we rather dilate the wound), but Hippocrates used a wedge, which he introduced betwixt the bones to poise them into their places †; and we even find La Motte ‡ using the levator of a case of trepan instruments (I suppose) for reducing the tibia.

Finding it impossible to reduce the bone, on account of the narrowness of the wound and its swelling and strangulation, you proceed to dilate the wound, you try to push in your fore finger or your little finger to conduct the bistoury, or, if necessary, you push in the bistoury, which makes way for itself; it is the straight probe-pointed bistoury you use. You have only one danger to avoid, that is, the cutting of the tibial artery, and to avoid that, you keep to the inner side of the leg, and opposite to the highest ridge of the tibia (not to the outside of the tibia, for the artery lies in the middle betwixt the tibia and fibula); you run your bistoury forward, and carry it pretty deep, till your finger which follows behind the

† And Fabricius, in the following paragraph, seems to approve entirely of the operation of Hippocrates. “ Si os retusum, et præfectum, adhuc difficulter coaptari queat, et metuiamus validam extensionem, in qua propter vulnus multæ fibræ distrahuntur, et dolor insignis excitatur, ut convulsio sit expectanda: tunc Hippocrates reponit fracturam quantum potest, et ferramenta quædam (vulgo Scarpelli dicuntur, i. e. Spathulus) altero extremo latiora et tenuiora, inter ossa fracta imponit, cœu cuneos quosdam, et modo vectis inflectit, ut sic ossa magis, quam muscoli extendantur, et reponantur.”

‡ Page 293.

bistoury passes in easily, and till you feel the stricture quite relieved. But if you find the bone splintered with points and spiculæ, which (if it were reduced) would run into the flesh, instead of reducing the bone in this dangerous condition, you bite off the sharper points with the cutting forceps of an amputation case, and having smoothed the bone, you may then, after dilating the wound, reduce it safely.

If you find at the same time the bone strangled by the narrowness of the wound, and pointed at its extremity, so that it would be dangerous to return it among the soft parts; if you are sensible that the bone is broken so obliquely, that though reduced, it would not keep its place, but allow the other bone to shoot over it, and at the same time so sharp pointed that the spiculæ would run into the flesh, you have then to make your election betwixt the two operations of dilating the wound and of cutting the bone; and as you prefer cutting the bone, you proceed not merely to smooth it with the cutting forceps of the amputation case, but to amputate it in the following manner: Your assistant takes a flat iron spathula to defend the soft parts with from the teeth of the saw, lays it flat under the bone betwixt it and the flesh, he holds it steady by one or two fingers on each side of the bone, and presses or draws it up edgeways betwixt the bone and the flesh, and the spathula being thus fixed, you proceed to saw the bone as close as possible to the wound with the small spring-saw, commonly put into the amputation case for the purpose (though never used) of sawing the finger bones.

Thus the bone, being cut into a plain and even surface, may be safely reduced, and keeps its place well.

Let us next suppose that the patient has not thrown himself from a window, nor fallen from a height, that the bone does not protrude, but that a loaded waggon has passed over the limb, and that the bones have been so crushed, that through one great wound a large piece of the tibia has been squeezed out, that the separated piece of the tibia projects, and is easily pulled away, that upon introducing the finger through this lacerated wound, you feel the bones all shattered, the splinters loose and moveable, the tibia destroyed to a great extent of three or four inches, according to the broadness of the wheel, and that upon insinuating your finger, you hardly distinguish the lacerated flesh from the bruised bone. You perceive that this is a more complicated injury, and will be surprised that parts thus macerated preserve their living principle, or survive even a few

days without gangrene ; but that the parts which are entirely destroyed, that the bones which are squeezed through the skin, should be regenerated by this mass of lacerated flesh and bruised bones, is almost incredible ! it is incredible, by how small a hold of the soft parts a piece of bone will sustain itself alive, preserve its circulation, adhere with the surrounding parts, and regain its connexion with the unhurt part of the bone ! In the most alarming circumstances you never despair.

You proceed then to disengage and pull away any pieces of the bone that are squeezed out ; you insinuate your finger into the wound, and hook out any pieces of bone that you encounter with the finger, and which seem loose enough to be hooked away ; and using the finger as a directory, you venture to introduce upon it the common small dressing forceps to lay hold on any loose point of bone which you cannot compass with the finger so as to hook it out. This is an operation where good sense and moderation are required ; it is not to be learned by experience, for it is an operation which few have an opportunity of repeating often ; it will be best performed by those who have studied the general principles of the profession, who have been accustomed to reason and to occupy their minds with the design and intention of each operation, rather than with particular methods. In dressing a limb thus shattered, you take away the pieces which are entirely loose, because they are plainly destroyed, and must produce suppuration ; you are at pains to get away the sharper splinters, though not so entirely detached, because they excite spasms by their immediate irritation, and cause abscesses after abscesses till they are discharged ; you use the finger more than forceps ; you would spare no present pain in order to put the parts in a good condition for lying easy, and recovering their healthy state ; and although you would take away whatever splinters might cause abscesses, you would not work too long with your finger, nor pick with your forceps too curiously, lest you should cause more suppuration by your own imprudence. But you perceive I might give you a volume of directions, and still be obliged to conclude at last, that I must leave much to your discretion and good sense.

OF SECURING THE BLEEDING ARTERIES.

Let us next suppose that the crushing of the bones is accompanied with a bursting or laceration of the arteries ; the blood always streams from the limb, and cakes about the wound soon after ; often small arteries bleed smartly at first, but

shrink before you can attend to them, and close entirely by putting a little bit of lint to the wound; but when the tibial artery, as often happens, is wounded, it bleeds so as to require attention. Sometimes you have occasion for the needle, but very rarely, for such is the effect of the laceration, whether by opening the cellular substance so as to receive the extravasated blood (or in what other way it is immaterial to determine), that even the tibial artery stops by merely applying to it a pellet of lint. If the artery continues to bleed, you must take a piece of sponge well dried, apply it as close as possible to the mouth of the artery, and make one of your young men hold it down for some time with the point of the finger.

But there is another kind of hæmorrhagy still more perplexing: the arteries are sometimes wounded from within by the sharp bones, the blood is extravasated, you open a large ecchymosis with the lancet, in order to prevent extensive supuration; the extravasated blood flows out, the skin falls down again, no more blood collects in that place, and you think all is right, and have no apprehension of any large artery being wounded, when suddenly, and at the distance of two or three days, a considerable artery begins to bleed from the bottom of the sac, and after bleeding outwardly, it threatens (when prevented bleeding openly) to inject the whole limb with blood.

Wherever an artery thus threatens to produce successive and dangerous extravasations into the cellular substance, you must cut up the skin and muscles to the place where the bleeding artery is, and although sometimes you may have occasion to use the needle, generally (even in this kind of hæmorrhagy), you have but to apply a piece of sponge.

Let us next suppose, that the fracture is made by a shot; that a gardener, for example, has loaded his fowling-piece with slugs (for watching his fruit during the night), and having forgotten to draw the shot, some unwary person, perhaps in play, has fired it at another, and standing quite close to him has wounded him in the leg or thigh. There is in this case comparatively little bleeding, the hole is round, and admits your finger; some of the shot has passed through, some has remained in the leg; the bones are entirely broken, or more properly shot away; your finger, especially if there have been a ball in the piece, passes through the centre of bone as clear as through the rest of the wound. In this case, the best instrument for removing the splinters of bone, the shot, and foreign bodies, is the finger; if you find particular splinters of bone, or if you feel shot flattened and niched in betwixt the splinters of the bone, you work them out with your dress-

ing forceps, or you use any small lever to pick them out with; and finally, to clear the wound of any pieces of cloth, &c. which may have been carried in with the shot, you may take a strap of fine linen, and with your long iron probe pass it like a seton across the wound, and draw it through, by which you entangle any very loose splinters of bone or piece of cloth.

OF REDUCING THE PROTRUDED THIGH BONE.

Let us next suppose, that in place of the leg, the thigh itself is fractured, not by a carriage passing over it, nor by being caught in the machinery of a mill, nor by the falling in of stones in a quarry, but has been fairly broken or snapped across by a fall, and driven through the skin and flesh. When the thigh bone protrudes thus, it protrudes forwards, and pierces the thick flesh of the thigh, making its appearance through the very centre of the Rectus and Crureus muscles. There is indeed less of irregular laceration than when two bones, as the Tibia and Fibula, are broken; there is in general one simple wound, and one pointed and projecting bone, but the strangulation round the bone is great, the reduction of it by extending the limb is almost impracticable, the finger is not allowed to pass into the wound, and when, by a little dilatation with the bistoury, the finger is admitted, the surgeon feels sensibly strong bridges of the muscular flesh, and considerable resistance from the tendinous firmness of the Fascia-lata. This is the case where (whatever we may determine as to the pinching off of splinters, or reducing the bone to a right shape) we choose to dilate the wound, both because of its natural narrowness, and because there would be unquestionably great danger of stricture were the Fascia-lata left entire; for when the whole thigh is swelled, the tension of the fascia makes that inflammation run into gangrene, which might otherwise have passed on to an easy suppuration, or might almost have admitted of adhesion.

In the thigh, then, so fleshy and muscular, and covered with this firm Fascia, the blunt bistoury should be carried pretty boldly forwards, and the wound very freely dilated.

OF THE RECOVERY OF THE PROTRUDED BONE.

But I cannot forsake the subject without representing to you once more, not only how easily a bone heals, but how difficultly it is destroyed; for upon the impression I make upon you in reasoning concerning this point, will depend much of your

decision and good conduct in practice. The natural firmness of a bone impresses us somehow with an apprehension that it is not organized like the other parts, nor endowed with the same living properties; we can hardly imagine so firm a part of the body to be able to renew quickly its connexion with the soft parts! yet, in fact, the firmness of a bone preserves its vital structure; you may bruise a bone to any degree, but unless you cauterize or burn it, you do not destroy its vital powers; in spite of the most extreme injury, it preserves tenaciously its living properties, and is more apt to renew its connexion with the soft parts, and to regenerate its lost substance, than perhaps any other part of the body; nothing but what destroys all its vessels, or at once deprives them of action, can destroy the life of a bone.

When a loaded carriage passes over a limb, when it is so squeezed in the wheels or rollers of machinery that its very marrow is pressed out, and large pieces of the bone forced through the wound, still the remaining part of the bone, far from being destroyed, lives and replaces the lost piece! When bones are protruded, and so pressed and locked in with one another, that none but the roughest methods can disentangle them; when it becomes necessary to wedge in a lever betwixt them, and poise them asunder, no part of them is destroyed, but the ends of a bone thus roughly handled live and unite with each other! When a loaded carriage has passed over a limb, recoiled and passed over it a second time, and then by the whipping-up of the horses has passed a third time over it; when the limb hangs double like a piece of flesh; when the bones are so crushed that the fractured part feels like a pap or mash, and no bone can be perceived in it, even then the bones, though crushed into impalpable pieces, do by no means lose their vital principle! such a limb sometimes heals with hardly any exfoliation of bone. When a person, perhaps leaping from a height, or running with violence, has broken the leg, he not unfrequently runs headlong two or three paces, the broken tibia (its medullary canal open), striking into the soft ground; and often a person falling from a tree, or buried with earth by the falling-in of buildings, has had the broken tibia driven deep into the ground, the foot being necessarily turned to one side, and yet the bone preserves its life and reunites with the soft parts! And what I have next to remark is quite a common accident, that when a compound fracture happens from the falling-in of quarries or coal-mines, the coal slack, the lime, the soil and gravel are so rubbed and mixed into the flesh and bones, that the bones are absolutely black, and yet being carefully cleaned, the flesh and bones perfectly adhere, or with very small suppurations.—No one can be surprised at these facts who has speculation enough to observe the condi-

tion of a fractured scull, where the parietal bone, for example, is fractured, depressed, trepanned, and raised up again, without its organization or vital principle suffering, or its circulation ceasing for a moment; it immediately reunites with the integuments, and with the adjoining bone, or if left bare of integuments, begins in a few days to granulate of itself.

No explanation can be superfluous which serves to give you confidence in replacing fractured bones; what I have explained is one of these general and important facts concerning the tenacity of life in bones which nothing but much experience could assure us of. This confidence the older surgeons wanted altogether; they kept bones always naked, they of course saw them always exfoliate, till this exfoliation came at last to be considered as a necessary and important step in the process of healing; Petit absolutely wrapped pieces of linen rag round the ends of the protruded bone to ascertain whether they were or were not alive †, and he continued to dress the ends of the bones apart till they exfoliated! but these pretences of Petit and other surgeons, of dressing with balsams, &c. parts which could be so very little benefited by any care of theirs, made the practice the more ridiculous. But exfoliation was the doctrine of the day, the older surgeons believed that no bone could heal without exfoliating, and that no wound could be cured without suppurating; they were at pains to wrap up in rags, to cauterize, to burn a bone, to keep it apart from the flesh till it exfoliated, for the same reason that they kept a wound open! for they would permit no wound to adhere, they would have it to suppurate, incarnate, and cicatrize; that they reckoned the only true canonical cure.

To doubt the life of the bone, and to insulate it thus, is to kill it; and since it was by wrapping up the bone in rags, and keeping it separate from the soft parts, that the older surgeons forced the ends of the bone to exfoliate, or, in other terms, destroyed its vital powers! we may be sensible that the best means of preserving the life and circulation of the bone, is by restoring, as far as possible, the continuity of vessels. Nothing is more necessary towards the healthy action of vessels than to be opposed to other living vessels: remember this principle in ma-

† “ Comme en ce cas il n'eût point été sûr de laisser recouvrir les os, je pansai la playe avec le charpi sec et des lambeaux de linge déchirés, de manière à tenir les os découverts jusqu'à leur exfoliation.” And at the third dressing he repeats the same process in a different form. “ Au troisième pansement, je levai tout, et je replaçai de gros bourdonnets qui faisoient le même effet autour des os, que les lambeaux de linge.”—“ J'observai toujours de bien couvrir et d'envelopper les bouts des os avec des lambeaux de linge fin, et avec des plumasseaux trempés dans de l'eau-de-vie.”

naging protruded or naked bones, whether in wounds, in fractures of the scull, or in compound fractures of the limbs; leave in their place all bones that are not absolutely destroyed, as by shot; separate none but what come easily away; be satisfied that where a piece of bone sticks firm, there will be vascularity enough to support it; reduce the protruded bones, and lay the soft parts close round them, that, if possible, they may adhere.

OF DRESSING THE WOUND.

This word adhesion leads us naturally into the next set of directions which relate to the treatment of the wound, and bandaging of the limb; your assistants have held the limb steady, and somewhat extended, and you have picked away the loose bones, reduced the protruded ends, stopped the hæmorrhagy, and cleared the wound of any gravel or soil that was forced into it; you now lay the eighteen-tailed bandage on the pillow; you lift the limb gently, and lay it upon the bandage; you and your assistants draw the limb gently, steadily, and with considerable force, model it with your hands, and give it a seat on its pillow or splint, and then proceed to close the wound. I defined a compound fracture to be, that which from the great laceration sometimes gangrenes, and often suppurates; but with care it may frequently be made to adhere. This is always to be your object.

When, after a simple fracture, the patient, by falling forwards upon the broken limb, has forced the tibia or thigh bone through the skin, the wound is not large, the flesh is cut, and not much lacerated; it is not only possible to make it adhere, but perfectly proper (after reducing the bone), to bring the lips as close as possible, and stitch them together, as you would do the integuments after the great operations of Hernia or Trepan. When, after a more terrible accident, the limb being torn by machinery, or by carriages passing over it, the laceration is great, you may be able, with the help of the needle, to bring two points of the wound together; but the sides can seldom be made to meet fairly, stitches are seldom useful, the sides of the wound are to be generally supported, by laying small and thin pieces of lint on each side of the wound; these pledgits of lint are soon soaked with blood, which cakes and adheres to the open part of the wound. By making small rolls and compresses of linen and soft lint, which you lay upon the edges of the wound (at those particular points where you apprehend a gaping of the lips, or where you apprehend that suppuration and cavities will form), you keep the parts very close. You then lay up the tails of the eighteen-tailed band-

age about the limb, and though you cannot use a roller (because that would require the lifting of the limb from its pillow at every turn), you give as much firmness as possible with the eighteen-tailed bandage. The steady firmness with which you support the parts helps the adhesion, prevents suppurations, and hinders an afflux of blood to the limb; over all, you may pour a little of some spirituous balsam, as the Balsamum Traumaticum.

When the limb is thus dressed, the wound which, while the bone protruded, seemed so very formidable, is very small, the pain is relieved, the very firmness of the limb is agreeable to the patient; you then apply the outside splints close to the limb, tie them moderately firm with their ribbands, and having, perhaps, bled your patient, you give him an anodyne and compose him to sleep; it is now that a situation which seemed very desperate is changed into a state of hope and expectation †.



18 Tailed Bandage

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† This is the eighteen-tailed bandage, called by the Germans, from its resemblance to a book, the Book-Band; it is made by sewing the cross tails obliquely upon one middle piece of linen, which holds them together, and keeps the several tails regular.

The navy and army surgeon, and especially those who go abroad on active service, should have store of every thing necessary for fractured and wounded limbs; of oil-cloth, not to lay the limb upon, but to lay upon the bed under the splint at the time of washing the limb; sponges for cleaning the limb with; pasteboard for the slighter fractures, as of the fore arm; thin shaven wood glued on leather, and then split with a penknife, for the fractures requiring firmer support; numbers of rollers, firm and made of linen, for flannel ones are very filthy by soaking up the matter, and very useless for want of firmness. He should have glue, which he will find very useful on various occasions, even of common wounds; he should have sheet-lead, which being glued upon pasteboard, makes a very firm and perfectly flexible splint, which is at the same time easily cut with scissars or a penknife; he must have tin-plate also, which being cut with coarse scissars according to the size and form of the fractured limb, can be pinched and turned

OF THE STAGE OF SUPPURATION.

Though you expect to procure adhesion, or at least to make some part of the wound adhere, you are often disappointed; you are sensible, from the violence of the fever and the swelling of the limb, that mischief is going on within. The dry skin, the parched mouth, the thumping pulse, the restlessness and delirium, continue for some days, and there is a blackness round the wound threatening gangrene. But this fever by degrees becomes less violent, the livor, which proceeded partly from ecchymosis, partly from the dark colour of the inflammation, gradually changes to green, the great wound begins to suppurate and open very wide, the whole limb swells to an enormous degree, the skin and cellular substance are soft and relaxed, and bear the impression of the finger, the redness extends over all the limb, and from the particular hollowness and softness of certain points, you are sensible that great suppurations are forming within.

All your prudence, and more especially all your diligence, is required for conducting this stage of the disease. You begin to reflect on the practice you ought to choose; you recollect to have seen a limb rolled in a mass of poultice even in the first days of the wound, when, by good and careful surgery, the parts might have been made to adhere! you remember in every hospital to have seen limbs lying rotting in this same rancid poultice at the very time that they are relaxed and inundated with their own matter! you know that it is contrary to every principle of surgery to solicit an afflux of blood to a member under such a disease, or to relax it with poultices, in place of supporting the general surface with bandage, and the particular hollow parts with compresses of lint or sponge: you know, that to say "a compound fracture cannot be properly dressed on account of the wound," is but an apology for the most ignorant and slovenly practice. Those who resolve to leave a limb thus rotting in its own matter, will, now that our fel-

easily with the thumbs, or can be easily hammered into a nicer form. In simple fracture of the thigh, a tin case lined with fustian, takes a good hold of the surface, and forms the machine of Hildanus; or in compound fracture of the leg or thigh, a tin case being fashioned and bended to the shape of the limb, and lined with oil-cloth, makes a safe and cleanly case, by which the patient can be conveyed safely at the time of the accident, and in which the limb may lie easy during the cure. The limb being washed and cleaned with sponges, may be padded up again at each dressing, by thrusting in little dossils of tow and scraped lint under the hollow parts, to equalize the limb, and raise the heel. A man is no more fit to be received into the army or navy, nor indeed to practise as the surgeon of a village, who is not able to make splints for himself out of the most ordinary materials, than a man is to announce himself as a dentist who cannot make artificial teeth.

low citizen Dr. Aitken is gone, have, I believe, no better authority than that of Belloste ; but he indeed gives both authority and reasoning. “ It is not at all improbable (says Belloste) that the sound matter *that comes from wounds may procure their cure*. This will be the more easily conceived by those that consider, that there are some learned and ingenious Italians who cure the bloody flux with a salt drawn from the excrements of the patient, and those who have the dropfy with a salt of the waters drawn from their own belly.” We need not reason against the practice, while others reason in this manner for it ; suffice it to say, that by laying a fractured limb in a poultice, reunion is prevented, the texture of the skin destroyed, abscesses created, while the whole limb becomes spongy and wellled.

Suppose you are called to recover a limb in this ruined condition, you first lay it in a large tin case which opens and shuts ; or upon a large splint lined with sheet-lead. You next wash the limb with soap and water, clean it from its filth, lay pieces of fine spongy lint upon the wound and upon the various openings. You then make the whole thoroughly dry, and moisten the surface a little with a sponge dipped in vinegar and spirits. You next apply adhesive plasters to the sound parts of the limb, which support it, and defend it from the moisture. You lay small cushions of folded lint to support the hollow parts, and lay scraped lint or small sponges to absorb the moisture ; and having one or two small pasteboard splints covered with leather (or covered rather from day to day with clean linen), you lay them along-side of the limb, and by tying two or three such splints on each side of the limb pretty firm with separate tapes or ribbands (which should lie always under the limb), you give a due support to the hollow and suppurating parts, and a comfortable and general support to the whole. The limb lies out meanwhile upon the broad and general splint, which being of tin, or lined with sheet-lead, allows the water with which you occasionally clean the limb to run off.

You are careful to dress the limb every morning, and perhaps to clean it also a little in the evening. By regular washing and wiping with the moist sponge, you prevent those smells which depress the patient's spirits, and injure his health ; and by laying clean lint to the wounds twice a-day, you soak up the foul matter ; by the occasional use of spirituous tinctures, you stimulate the skin, and keep it in good condition ; by washing the excoriated parts with salt water, you relieve the itching. You examine the hollow and yielding parts of the limb carefully, and after each fit of inflammation, you feel anxiously with the point of the finger for

any abscess it may have occasioned. You find new suppurations produced, sometimes by the extravasations of blood, sometimes by the pricking of splinters, or sometimes from matter lodging in hollow places; you open such abscesses with the point of the lancet, soak up the matter with scraped lint, and lay small compresses upon the hollow places, by which you heal them, and make the internal parts unite.

This is a plan of conduct altogether opposite to the filthy oil-cloths, pillows soaked with matter, rancid poultices and fomentations, in which you so often see a limb going to destruction. By thus carefully cleaning and dressing the sores, you make such changes, that in the course of a few weeks, a limb which had been condemned by a consultation, is manifestly saved.

The importance of attending to the general health, and even to the most trivial circumstances connected with the ease and comfort of the patient, is very great; you should be careful to have the windows open and the room ventilated, to change the linens, to make your patient wash his face and hands with cool vinegar and water, and when the matter is very profuse, to have the room fumigated with vinegar. You give nourishing food in small quantities, wine according to the constitution and habits of the patient, anodynes according to the degree of pain, fever, or restlessness, and laxatives when they are required. You give the Julapium Siftens and other astringents, and anodynes when the diarrhoea is violent; you give sometimes gentle emetics upon the attack of nausea and fever; and as for bark, I believe, in place of reminding you to give it when the suppuration is great, I must rather (so common is this prescription) advise you against overloading your patient's stomach with this heavy drug! three or four drachms of bark is enough to sicken the appetite of a man in health, much more of a man confined for six months to lie on his back.

How much is due to care and cleanliness, you may judge from this, that in the case of a gentleman who lies in his own house, we often venture to save a limb, which, had the accident befallen a poor man lying in a crowded hospital, must have been cut off. In hospitals, especially in military hospitals, and most of all in Hospital-ships (which the Lords of the Admiralty would do well to burn), the patient sinks almost inevitably under the suppuration of a compound fracture.

Often it happens, from the destruction of parts, or the unhappy circumstances of the patient, that all your cares are unavailing! every time you examine the limb, you make discoveries of more extensive destruction, you find the whole

limb swelling every day more and more, you find the matter running profusely from the openings, the openings increasing in number, and the suppurations extending from the ham to the heel with intolerable fœtor, the muscles all undermined, and the bones carious. You find that you are no longer able to support the patient's health, that repeated attacks of diarrhœa and fever have reduced him to extreme weakness; and the wan visage, the pale and flabby flesh, the hollow eyes and prominent cheek bones, the staring and squalid hair, the long bony fingers and crooked nails, the quick, short breathing, and small piping voice, declare the last stage of hectic and debility! the natural powers are then sunk so low, the appetite for food, and even the desire of life so entirely gone, that we would believe the patient past all help, did we not know by experience that it is never almost too late to amputate the limb.

Now, it is come to that crisis when our patient must die or part with the limb he has suffered so much to save; but he is wearied out with suffering, and consents easily to whatever we advise; and whatever the difference of opinion on the first consultation, when the limb was first laid on its pillow all bleeding and shattered, with its bones projecting and its arteries torn, there is none now that it is thus undermined with suppurations, with universal caries of the bones; the first was a state of expectation, the second is a condition where we must despair. When we are thus sensible that further attempts to save the limb are incompatible with the life of the patient; when we perceive plainly that the limb thus mangled, shortened, and imperfectly cured, would be rather a load to the patient, and a perpetual reproach to the surgeon, we perform amputation! there can be no difference of opinion now, because the experiment of trying to save the limb has been tried, and has failed.

OF GUN-SHOT FRACTURE.

Gun-shot fracture is the one which, though by far the most formidable, appears at first the least dangerous; it is a small circular wound which admits the finger, has little sensibility, is often bloodless, and when the patient is struck, he feels rather surprise than pain; but when the bones are fractured, the pain is sometimes very exquisite, and always the wound degenerates in consequence of the destruction of the bone into a foetid sore, with fistulas, foul matter, and a discharge of carious bones.

When a wounded man is brought to you, you find, perhaps, one single wound

in the thigh, the limb bending, the bone broken, perhaps some large branch of the profunda bleeding profusely, and the man faint and sick. You immediately lay him in the floor of the cock-pit, or when brought to your tent in the field of action, you lay him upon a bed, or upon the bare ground. You lay a large splint (or any coarse board, any spar of wood) under the limb, to prevent it bending and being more injured; if the blood flows profusely, you thrust a piece of lint into the wound, and hold it steady with your finger; you call your assistants, and one gives him a cordial, another cuts off the breeches, while you, by pressing with your finger, prevent loss of blood. The wound being in the thigh, where strangulation from tension of the fascia is to be feared, you are more willing to dilate the wound; and the bone being shattered, and a large artery bleeding (for in a gun-shot wound no small artery ever bleeds), makes the dilating of the wound a matter of absolute necessity. Your finger then being still kept steady upon the wound, is to conduct your bistoury; you lift your finger, draw out the bit of lint, pass your finger into the opening, push in your probe-pointed bistoury upon the finger, and as you open the wound, you push your finger deeper until you feel distinctly the jet of warm blood; then fixing the point of your finger fairly upon the mouth of the artery, you lay it open, and according to its size, either tie it, by making a plunge with the needle so as to surround it, or suppress the bleeding, by pressing a morsel of dry sponge down upon it.

Your assistants now extend the limb, and hold it very steady; while you push your finger deeper into the wound, you hook out the splinters of the bone, then you feel a piece of cloth or a button of the breeches, and with the help of a probe, or lever, or dressing forceps, you hook it out; you find a piece of the ball and also pick it away, but you are sensible that the rest of the ball, or that one of two balls with which your patient was shot, lies very deep; you find the wound extending beyond the reach of your finger, you find that it has passed almost through the thigh, and having reason to believe that the ball is near the skin on the opposite side, you make an incision there (called a counter-incision), and extract the ball, together with whatever splinters of bone are driven to that side.

The shot having passed through the thigh bone, you get out the ball, pieces of bones, cloth, buttons, keys, sword, belt, and other foreign bodies in this way with the finger; when the shot has passed through the fore arm, or tibia and fibula, or through a group of bones, as the carpus or tarsus, it is sometimes useful to draw a slip of dry linen through the wound with your long iron probe.

The wound being thus cleared, you proceed to dress it, not with any expectation of procuring adhesion, that in gun-shot wounds is impossible! you never pretend to stitch a gun-shot wound, though I have actually seen this absurdity committed. You put adhesive plaisters round the limb, because you know that it must lie long soaking in suppuration; you bring the wound close together with compresses upon the sides of it, a piece of fine lint over the mouth of the wound, and you bind it with a strip of fine linen. You lay the member on a firm splint or case of tin, to prevent any bending of it, and you dress it always perfectly dry; you pour sometimes a little spirits upon it, using no poultice nor any thing but compresses of dry lint, padded splints, and circulars of ribband to tie them with and to support the limb. You should never forget this circumstance, that the rangers in the woods, who never are within a house, who are continually exposed to fresh air, in constant motion, and living from necessity on a spare diet of the coarsest kind, who merely bind up their wounds with a piece of lint and a slip of linen, heal to a miracle! while those who are nearer what is called help, who are thrown into a foul hospital, and who, if they are able to walk, loiter about in idleness and nastiness, or who, if wounded in their lower extremities, lie with oils, poultices, and rancid ointments applied to their limbs! infallibly sicken and die.

In the progress of such a wound, the sloughs will come away spontaneously, the suppuration need be encouraged in no other way than by supporting the general health, the carious bones will usually be discharged of their own accord, perpetual care is required in keeping the wound clean, close, and dry. The way of curing the fistulous sores that remain after gun-shot wounds, has been already explained †.

† As an admirable example of diligent practice, I think it right to give the student an opportunity of reading the following most instructive case from Wiseman, and which, from his dramatic manner of representing it, is not less interesting than instructive.

“ In heat of fight at sea, among the many wounded men that were put down into the hold to me, one of them had his right arm extremely shattered about two fingers breadth, on the outside above the elbow, by a great splinter. I ought to have cut off this man's arm presently; but a sudden cry that our ship was on fire put me in such disorder, that I rather thought of saving myself than dressing my patients. I hastily clapped a dressing upon the wound and rolled it up, leaving his arm in his other hand to support it, and endeavoured to get up out of the hold as others did, verily believing I should never dress him nor any of them more; but our men bravely quitted themselves of the fire-ship, by cutting the spritsail tackle off with their short hatchets (which they wore during fight, sticking in their sashes); so we were freed of the fire, and by our hoisting up the topmasts, got clear of our enemy, and I returned to my work; but I was at a

OF COMPOUND FRACTURE AND LUXATION,

WHEN THE JOINT IS DISTORTED, THE BONES FRACTURED, AND THE INTEGUMENTS LACERATED.

It is in the lower extremity only, which bears the whole weight of the body, that we are to look for such complication of injury as is described in these words; and however a compound fracture of the arm or fore arm may destroy the part itself, life is actually in danger only in great fractures of the lower extremity, which forms so great a proportion of the whole body. The ankle joint is never dislocated unless when the Fibula gives way; it is never entirely distorted, and the foot turned transverse, without both bones, both Tibia and Fibula being broken; and when it is entirely dislocated, the integuments are torn at the inner or outer angle, and often the tibia or the astragalus are forced through the wound, and the head of the bone on which the body rests quite exposed. If

lofs what to do with this man, who lay not far off complaining of his arm; I would have cut it off instantly with a razor (for the bone being shattered, there needed no saw), but the man would not suffer me to meddle with his arm, he crying, it was already dressed.

The fight being over, and we got into the next port, I caused this mariner's bed to be set up (which was four pieces of wood nailed together and corded, and a bear's skin laid upon it, and fastened between two guns to the carriages); upon this I saw him placed; and having ordered his arm to be laid so that I might the better come to dress it, I sent for dressings, and laid them orderly upon a small pillow well stuffed and quilted in the middle. Upon this pillow I first laid a soft double linen cloth, next to that three ligatures, then a pasteboard wet in vinegar, to make it more soft and pliant; upon that I laid a double cloth, of such length and breadth as might serve to encompass the fractured member, which I cut from each end to the middle into three binders. Over the middle of this I placed a splenium of cloth four double, four fingers in breadth, and of such a length as to give strength to the fracture. Over this lay my defensive spread upon a thick cloth, of such a breadth and length as to take in the whole arm. Dressings thus laid upon the pillow, I cut off the other from his fractured arm, and placed the pillow with these dressings close by his side, so that I saw his arm laid as I designed upon my restrictive, and his hand upon his breast; then putting my fingers into his wound, I pulled out first a piece of a splinter an inch thick or thereabouts, more or less, then rags and bones, great and small; I left not the least shiver. When I had so cleared the wound of all the extraneous bodies and loose bones, I was amazed to feel what a void space there was between the ends of the bones; but I proceeded, and cut off the lacerated lips, which were of no use, and dressed up the ends of the bones with a couple of dossils dipped in spir. vini and mel. ros. warm. The rest of the wound I dressed as warm with axung. porcin. and merc. præcipat. with some little ol. terebinth. spread upon dossils, which I placed lightly within the wound, and upon pledgits without, with an empl. diachalcit. malaxed with ol. myrtill. over all the wound; then I embrocated the fractured arm cum ol. myrt. et olivar. immatur. and a little acetum, bringing my restrictive emplaster, which lay under the arm, over the whole arm, from the arm-pit to the elbow, and close round about, only leaving a space to dress the wound.

a man falls from a height, and lights with one foot on a round stone, the foot is turned to one side, the integuments are burst, the inner ancle or process of the Tibia protrudes, and the Fibula is broken, so that the foot is turned entirely to one side. If, again, a horse rears and falls above its rider, if a man's foot is caught in the machinery of a mill, if a man falls from the back of a carriage and his leg is entangled betwixt the spokes of the wheel, the foot is turned round, the integuments burst, the Tibia and Fibula are more or less exposed, and the astragalus or bone on which the leg is supported, is either broken or turned entirely out from its socket, disengaged from the Tibia, and almost separated from its connexions with the other bones of the foot. Whether the Tibia only is protruded, or the astragalus displaced, or both, you perform the same operations; and whatever may be the decision of a consultation afterwards, your duty is immediately to replace the foot and close the wound. Always, you proceed in the first instance as if you had no doubt of saving the limb.

This gave a strength to the weak member, and was designed to prevent the influx from above. Just under this emplaster there lay a splenium. To answer that, I applied three more, one on each side, and another above; which four were of such a size, that they lying a little off from one another, encompassed the arm. They were spread lightly with a little cerote made of axungia, and wax to make them adhere where I placed them.

Then I brought the bandage which lay under the splenium, with three heads at each end. The lowermost of these took in the lower part of the arm from the elbow upward, with part of the fracture, and was fastened on the exterior part of the arm. This pressed the sanies from the nether part of the arm to the wound, and hindered the lapse of matter that way. The middlemost was made to press the matter out of the wound, and keep the lips down; the uppermost served to restrain the influx, as I said, and pressed that matter out which was already in the part. This bandage was made with great moderation, and so fastened, that it might be loosened without trouble to the patient. Then I brought the wet pasteboard close to the sides, and cut another piece to answer it, which I wetted in aceto, and by the three ligatures under made them fast, but without disturbance to the patient. If it could not have been so put on, I should have foreborn the use of them, the cure of these wounds consisting in the easy dressing and quiet position, without which you will not cure one of them. The pasteboard, as it dried, stiffened, and retained its shape, preserving the fracture in the position I left it, and that with a very slack bandage. Thus I finished the first dressing, leaving my patient in much ease. He slept pretty well that night, and was the next day as well as I could expect. He was let blood the second day, and kept to a spare diet; but we allowed wine as a cordial to all our patients.

The third day I dressed him again, took off the upper pasteboard, and loosened the heads of the main bandage; also I took off that splenium which was over the wound, and raising up the emplaster from the wound, took out many dossils, found it warm and well disposed, and dressed it up quick with my suppuratives hot, and an emplaster as before. I stirred not the restrictive, but made now a compress more par-

In general it happens, that the Astragalus or Tibia having burst through the integuments, the bones are so strangled in a small slit or opening, that no degree of force will reduce them; you do not, in this case, cut off a bone so necessary to the joint as the inner process of the tibia! you never, unless it be already entirely separated, cut away the astragalus; you first extend the foot very powerfully, and press in the astragalus, and try to reduce the bones; but failing in this, you make a free incision, extend the foot, replace the astragalus betwixt the processes of the Tibia and Fibula, and having closed the wound, you lay a piece of lint upon the lips of the laceration. You then place the limb on a large and stiff splint, in a manner which surely I need not explain, and with such pillows, compresses, and bandages as you find necessary for keeping the foot in its right position with regard to the leg. All this is not easily performed, sometimes bone-setters have two or three of them attempted for several hours to reduce a luxated ankle, but in

particularly for the wound, purposing not to remove the two outermost heads of the main bandage, unless it were sometimes to give a little breathing to the member; but the middle I opened as often as I thought fit, to dress the wound. The other two had short splenia to make the bandage equal. But I was not then satisfied how the space between the fractured ends of the main bone could be supplied with callus. My patient was easier than any of my other with fractured wounds. When it came to my turn to be visited by my brother surgeons of our squadron, they did not dislike the wound, nor my way of dressing (for we being used to see one another's patients, had all much one way of dressing), but they laughed at the excuse I made for not cutting off his arm, and doubted I should be yet forced to do it. But I kept my patient flat on his back, and that after a while was his greatest pain; for the wound digested, and the tumor was not then considerable. After the wound was well digested, and the bruised flesh separated, I renewed the dressings, taking all the old ones off, and fomented the member with warm water, to give a breathing to it; then applied a catagmatic emplaster, dressed the wound with mundific. Paracels. or such like, and bound up the member as at first, and so continued my way of dressing as I saw cause, putting into the wound only a dossil or tent made upon a skewer, soft and hollow, to give way to the wound to incarne; I scarce using any injection, but by gentle compression assisting Nature, who seldom faileth in supplying the lost substance in wounds, if we disturb her not by improper applications. The next taking off and renewing these dressings of this fractured member was occasioned some sixteen or seventeen days after, by a troublesome itching of the part, which was occasioned, I suppose, partly from his liberty in diet, partly by the heat of the weather, and want of transpiration. Upon this account I took off the dressings, bathed the member with sea-water, and dressed him up with emplast. de lithargyro. The wound was about this time well incarned within, and the lips beginning to cicatrize from their edges; I dressed them with epulotics, as unguent. tutiæ, &c. All this while I kept my patient upon his back, and renewed not the whole dressing until I was again necessitated. One day coming from the shore (where our wounded men had liberty to lodge, if they desired it, and were dressed up by us there), I found this patient with a heat all over his body like an erysipelas, at which he was much affrighted. He had, it seems, drank wine too liberally with his mates (as they would most of them do, if they were any thing well), unless it rather proceeded from a

vain, from not daring to make the necessary incision: Sometimes also the best and most ingenious surgeons have endeavoured in vain to keep the foot right, which, although bandaged to a firm splint, or lodged in a square box, and bent into the best position with compresses and wedges, has been found distorted from time to time. This difficulty I have often experienced, and yet must leave you to your own ingenuity, for you have time to contrive means of restraining this tendency of the foot to turn aside, and the contrivances are of the most obvious kind.

The limb being thus laid, you are not to promise yourself absolute success, but the surgeons whom you have sent for being arrived, you consult together upon the probable event of the case; and so very favourable is the aspect that matters assume after those operations have been nicely performed, that the consultation will very rarely order the limb to be cut off; they soon leave you to your own prudence, and advise in general terms that every thing should be done to preserve the limb. You are now afloat and must abide the chance of time and circumstances, for after a day's delay the limb is inflamed, and you never call a second consultation; it is too late (whatever changes come upon the limb) to perform amputation with success; nor, indeed, must you be alarmed at the appearance of gangrene, even in this case, where gangrene is so often the cause of death, for the force with which the parts are twisted, or the bones driven through the skin, occasions an extensive ecchymosis, which reaches along the leg and up

generation of callus, in which case it usually happens. I let him bleed, and dressing him as in an erysipelas, finding his arm pretty strong, and his wound healed within, and in a fair way of cicatrizing, I raised him up, after he had lain about eight weeks; all which while, I believe, he never stirred his arm from the time I first placed it, but only while I renewed the dressings, he being the most patient man in that respect I ever attended; and in truth, without that submission, he could scarce have been cured.

There was in this patient a strong callus filling up the void place of the lost bone at least two inches, with little or no shortening of the arm; but the joint of the elbow was so stiff from the position it lay so long in, that he could not stretch that joint whilst I knew him, which was until that ship was cast away.

My memory will be much cried up for remembering so many particulars in a patient so many years since cured by me; but if you consider how remarkable a case it was, and in my trade, there will be less wondering at the possibility of it. You may inquire what was done by me in the cure of Captain Reade, where the loss of his jaw was supplied by a strong callus, and that cheek made uniform with the other. It will be long remembered by the then standers-by, though not of our profession. In our sea-fights, oftentimes a buttock, the brawn of the thigh, the calf of the leg, are torn off by chain-shot and splinters. All these are contused wounds, and look black, and do too often deceive the unexperienced chirurgeon, he taking them by their aspect to be gangrened, and by dressing them as mortifications with *Ægyptiac*. and *spir. vini*, doth certainly sphacelate them, and those persons die miserably afflicted."

the thigh itself, so that the whole limb is almost black. Nay, you must not be alarmed even though this blackness turn into a true gangrene, though vesicles rise, the part lose all feeling, and the patient lie in a degree of stupor; for such gangrene is often but superficial, it is confined to the skin, it is limited even to a small portion of the skin, and in eight or ten days small sloughs are thrown off, the suppuration is established, and the patient revives. Such laceration seldom or never adheres immediately, yet is often cured by suppuration; and sometimes when pieces of the tibia and fibula have been separated and thrown off, when the astragalus has been fractured, and one half of it cut out by the surgeon, the joint has healed; nay, it has even happened that the astragalus has been so entirely twisted out of its place, that it has mortified and been removed by the surgeon, and yet the gangrene has ceased, the suppuration has been established, granulations have filled up the great hollow, the outward wound has closed, and (though it is difficult to believe so surprising a fact), the bone has been so far regenerated, that the patient has walked firmly on that foot, and with a free motion of the ankle, a new joint having been formed. Yet you should be aware, that such cures are never perfect; after even the least of those accidents the joint continues long weakly, always rheumatic, apt to swell with the slightest fatigue, and requires to be firmly supported by a well padded buskin laced firmly round the joint; I have seen some patients, indeed, who did not absolutely need this, but few who did not acknowledge the comfort, security, and strength it gave them.

OF THE QUESTION OF AMPUTATION.

I have, in the course of those practical rules, studied to impress you with confidence in the powers of nature, and have laid before you all those considerations which may encourage you to preserve the limb, even when apparently destroyed. I have explained, that though the bone be protruded three or four inches, the foot not only turned to one side, but pushed upwards along the bones of the leg, and much of the projecting bone cut off, the limb may still be saved. That when, in the transports of delirium or mania, the patient starts from his bed, and dances and runs upon the protruded tibia; when loaded waggons or machinery have so crushed a limb, that several inches of the bone are squeezed out, still the limb may be saved. I have represented to you how a man shot through the arm, neglected from the confusion of a battle, laid afterwards upon a bear's skin, ex-

tended betwixt two carriage-guns, and with some inches of the shoulder bone shot away, may be saved †. I have explained to you, that the injury seems dreadful and irrecoverable in the first moment after the accident, whereas, after the first operations of smoothing and reducing the bone, every thing assumes a most favourable and flattering appearance; and I have hinted, that a consultation of surgeons might condemn a limb in the first moment (while lying in a shattered and disordered state), who, upon seeing it reduced and dressed, would find reason for hope, and would be not unwilling to trust to time and good conduct. And finally, I have taught you not to be rash in sacrificing a limb, not to be absolute and decisive in any case, that only excepted where the experiment of trying to save the limb has been tried and has failed! where the patient is dying from profuse suppurations, but so slowly as to give time for both surgeon and friends to be convinced that the amputation is a matter of necessity and not of choice.

I have just mentioned, that in luxation of the ankle joint, even the Astragalus, the great bone of the joint (a bone not inferior in size to the head of the thigh bone), may be displaced, separated, and cut entirely away, and yet the limb be saved; yet this, Gentlemen, is the case in which, according to my experience, gangrene is so apt, or rather so sure to happen, that those who have been saved after such an accident, have been saved by chance, while hundreds have died of the gangrene which usually ensues: A successful case now and then in a medical journal obtrudes itself upon your notice, but it is one case picked out of ten thousand. When you are called to a case of this kind, you take immediate measures for restoring the parts to their natural situation, and putting the patient in a state of ease and comparative safety; but your chief duty is that of calling together a consultation of surgeons, to decide whether or not you should attempt to save the limb. The mention of this question never returns without producing serious impressions on my mind, and I believe I cannot close these Discourses more usefully or respectfully, than by saying a few words on the subject.

I am sorry to observe this the most important question perhaps in surgery, treated as if it were no question, but rather a rule of practice, which might be established on the most absolute grounds! When a surgeon condemns a limb, he does not say, that if amputation be not instantly performed the patient will die, nor is he disappointed if the limb be saved; he thinks both more sensibly and more humanely. He knows that there is great danger of losing the patient's life

† Vide foot note, page 660.

in attempting to save his limb, and reckons it his appointed duty to advise amputation; but he is still sensible that the limb may possibly be saved, and often, after his honest opinion is rejected, contributes, by his attention and kindness, to that most desirable object. Sometimes he feels it to be his duty to advise amputation, and to represent very strongly the manifold dangers of attempting to save the limb, while yet he rejoices to find his patient willing to hazard all those dangers, in favour of an object which it must be the chief honour of the surgeon to accomplish.

But there is yet another thing to be regarded, as well as the great object of saving the patient's life, for there never is an unqualified and perfect success. The patient feels nothing but the desire to save himself from the deformity and lameness which amputation causes, little thinking how deformed and lame the limb may prove after he has passed through every kind of danger and suffering to save it. But we have much more to reflect upon, and much broader grounds for reasoning. Let us but consider, if (in a case of very dangerous fracture) the man die, how great the loss, the disappointment, and the regret of friends; even if he live, how great his own sufferings, and how imperfect his cure! A man, for example, in the middle age of life, has his limb crushed, so that consultations are convened on the question, and it is thought just possible that it may be saved; he is laid in bed, and the necessary operations of dilating the wound and reducing the bones are performed; abscess, caries, hectic, and every kind of distress ensue; for two years he lingers in his house, and then is carried to a succession of watering places in hopes of recovering his health. He is lame and walks on a stilt, and his natural constitution has received an irreparable shock; he falls in the course of those two years of distress, from the condition of a young and healthy man, to the state of a valetudinarian, dispirited and dejected, travelling now the downhill way of life; he has lost his health and saved a limb, which he drags after him with labour and pain.

Now this is much to be regarded, for often the limb is so ruined, that no surgeon could wish it saved. The surgeon in condemning a limb, regards its mangled condition, and can hardly be so imprudent as condemn that limb which is so little disordered, that it may not only be saved, but may become shapely, strong, and useful. The present dangers of the patient, the danger of losing his constitution and health, and the mangled and hopeless form in which the limb lies before the surgeon, all bear upon his mind, when he declares with

reluctance that it should be cut off. When the case seems thus hopeless to the surgeon, the complication of chances is very intricate! The patient may die of the immediate injury and gangrene; or he may survive, while the limb, already seized with gangrene, may be destroyed, separating naturally, or with a little help from the surgeon. The limb also may be saved, as well as the life; it may escape the gangrene, but the degree of injury which threatens gangrene usually leaves a limb so deformed and shortened, that it proves a mere load and encumbrance to the patient, and hardly an honour to his surgeon. Lastly, The limb may, notwithstanding this dreadful and complicated injury, turn out a clean, shapely, and useful limb; but how small the chance of this perfect recovery, after the limb has been condemned by a judicious and humane man, who understands his profession, and has added experience to knowledge?

But let us not argue this as an abstract question, but come to some sensible and visible proofs. First, I suspect, and indeed I dare affirm, that often the surgeon repents of the limb he has saved at the risk of the patient's life. La Motte having saved the life of a young man who had his arm and leg both cruelly fractured, by his horse falling with him upon ice, acknowledges that paralysis of the wounded side came on a few days after the accident, and that he was so imperfectly cured that he dragged the limb after him entirely lame; he then asks the question himself, "May it not be doubted, whether we should not in such a case have judged more wisely in amputating the limb †?" But other authors as ingenuous, as worthy of credit, leave no such doubts, do not apologize like La Motte, by saying that the boy, even in this condition, preferred his own mangled limb to a wooden one, but declare to us plainly, that their patients, though old and of a humble station, could not endure their situation. "Esther Parsons (says Mr. Lucas) was admitted into our infirmary with a compound fracture; one of her legs was taken off above the knee; from the other leg, four inches of the tibia were removed, and due pains taken to make the woman as comfortable as her deplorable situation would allow."—"After a confinement in bed for upwards of *ten months*, various attempts were made to support her on crutches; but after trying this for a few weeks, she endured so much pain, that she begged to have the remaining limb amputated, for it was to a degree burdensome to her, without a prospect of any amendment ‡." This patient now was a woman, with all the fears and delicacies

† "Doutant si dans le commencement nous n'aurions pas mieux fait d'en venir a l'amputation," &c.

‡ Page 234.

of a woman; was advanced in years, and reduced by suffering of every kind; her employments sedentary, and her sex not requiring any active way of life; she had felt the pains of amputation and the loss of a limb; she could compare her future situation with her present misery, and yet such was her sense of the distress of carrying so unwieldy a limb, that though just returned as it were from the dead, she was ready once more to submit to a terrible and dangerous operation. I myself have seen a patient require the amputation of such a limb, and have seen it performed, it was crooked in behind the sound one, and was a serious occasion of distress and trouble.

Secondly, I suspect, and can also venture to maintain, that surgeons often give a favourable report of limbs too miserably shattered to be soundly healed, only because they have had the good fortune to preserve them. But had it so chanced, that the surgeon had condemned these same limbs, and the patient refusing the surgeon's advice, had persisted in preserving them, we should have had them described in very different terms. One of the oldest of the modern surgeons, in a fit of peevishness, has let off a description of this kind, which has amused me: "A young lady," says Saviard, "Mademoiselle Duclos, on the 8th of November 1694, was buried, along with numbers of others, under a pile of wood; twenty were killed, but this lady escaped with a dreadful fracture of the leg, in which the astragalus was luxated, and indeed quite turned round, while many splinters of bone protruded through the skin. The limb was in a condition which, according to all rules of good surgery, required amputation; but Messrs. Bessiere, Gigot, and myself, though we delivered one unanimous opinion, could not persuade her to submit to amputation, all our arguments, prayers, and entreaties were in vain. After many months of suffering, and various suppurations, she was at last cured, with the loss of the lower head of the tibia, especially that portion which articulates with the astragalus and forms the inner angle."

"This lady remains (says Mr. Saviard) in the very condition that Mr. Bessiere and myself predicted, walking on stilts, dragging after her an unwieldy and shapeless limb, distressed with frequent pains, while, by submitting to the operations we proposed, she might have escaped indescribable distress during this very tedious cure; she might, indeed, have been very soon cured, and soon able to walk with pleasure †." It is, no doubt, an unhappy sight for a patient to look to his wooden

† "Elle est restée depuis dans l'état que nous luy avons prédit Monsieur Bessiere et moy; c'est à-dire, avec une grosse jambe incapable de mouvement, souffrant de temps en temps des douleurs considerables,

leg, and reflect that it is possible his limb might have been saved to him ; but let him compare his condition with that of a person dragging after him such a mass of macerated flesh and crooked bones.

I believe I shall give the clearest view of this subject, by telling you that I do not regard the most perfect success as a proof of judicious practice. I will even venture to describe one of the most unprecedented examples of success in the cure of a bad compound fracture, as an instance of that very situation in which the limb ought, by all the rules of surgery, of prudence, and of common sense, to have been cut off.

It is a case related by the celebrated Verduc, nearly in the following terms : A man about seventy years of age, was thrown down by a waggon, in a street where the declivity was very steep ; he fell flat upon his face, the wheel went over his leg and fractured it very cruelly. The driver, confounded at what had happened, allowed his waggon to recoil, and the wheels running backwards on this steep declivity, passed over the old man's limb a second time, then the villain seeing what destruction he had made, and expecting to make his escape, whipped up his horses and drove his waggon a third time over this shattered limb. When the wounded man was brought to me (says Verduc), I saw a great wound in the lower part of the leg, with a prodigious hæmorrhagy, and then taking the leg in my two hands, and bending to the inside and outside, I perceived that it bowed on all sides, and had no other stay but the flesh ; and to make this accident as formidable as in nature it could be, the old man had an ulcer with caries of the bones, at the very part of the ankle where the wheel had passed and repassed, which carious ulcer he had suffered during forty years.

Verduc stopped the bleeding with lint and compresses, and astringent powders. He put two splints as props under the fractured part of the limb, laid his patient on a ladder with quilts under him, and had him carried home ; in carrying him up stairs, the limb, in spite of every precaution, suffered a good deal. After laying him in bed, the limb was again dressed more regularly and carefully ; the hæmorrhagy was suppressed, yet it returned again, so that at midnight all the dressings needed to be renewed. Next day another surgeon was joined with Verduc

contrainte de se servir de bequilles, pour se transporter d'un lieu à un autre : au lieu que par l'amputation que nous lui avions proposée, elle se seroit épargnée les douleurs incroyables qu'elle souffrit pendant ce long traitement ; elle auroit été bien plutôt guérie ; et elle se seroit trouvée bien-tôt après sa guérison, en état de marcher avec plus de facilité."

in consultation, they found half the leg, and all the upper part of the foot gangrenous, amputation was proposed, but Verduc by his particular care stopped the gangrene and saved the limb.

Let us next observe, according to the regular course of the narrative, what this old man suffered, and how he was cured. The sloughing of this superficial gangrene of course carried away the skin; the muscles which bend the foot lay exposed and quite putrid, so that the surgeons needed to make deep incisions into them; and by the tenth or twelfth day, the tibia (long carious and now destroyed by the fracture), lay bare to the extent of two or three inches, and was as black as ink; the Tendo-Achillis was also exposed. This was the first disorder produced by the gangrene, and you may judge of the state of the limb, after the exfoliation of the tibia, by this, that the want of the tibia so enlarged the hole into which Verduc was accustomed to throw his cleansing injections, that you could see through and through the leg! while the shattered fibula on the other side produced (by its points sticking in the flesh) a succession of suppurations and ulcers.

After six months the condition of the limb was little improved, the fibula was still exfoliating, the abscesses were renewed from time to time, the fibula was bare and carious, and Verduc was busied applying actual cauteries to the bone at each dressing; there was formed also a gangrenous ulcer of the heel, which required the limb to be lifted and dressed daily for two months. Nor is it to be forgotten as a real picture both of the sufferings of the patient, and of the diligence required on the part of the surgeon, that through all the six months during which the corruption and putrefaction, and various grievous disorders lasted, Mr. Verduc employed every day five or six hours (including morning and evening dressings) in preparing the apparatus and cleansing and dressing the sores.

“ I reckon (says Mr. Verduc), that this complicated fracture may serve as a model and general rule for all that I can say upon this head; but what was the happiest circumstance of all, the patient recovered perfectly in the space of eighteen months; six months after he walked, at the age of seventy-two years, without a cane, and he lived nine or ten years after.”

So happy a circumstance was this recovery, that I think it almost a miracle; so great was the merit of Verduc in preserving this limb, that he was, in my opinion, much to blame in making the attempt. Such pains as he took were very commendable, but then “ all his service in every point twice done, and then done double,” was but a poor recompence for the rash attempt he had entered upon.

The man survived, and Verduc had a proud tale to tell; but had he died! what could Verduc have said in vindication of himself, hazarding in this manner the life of so old and diseased a creature? Were this very case submitted to my judgment, should an accident in all respects parallel happen again, I would reflect on the case of this man only as a mere exception, as an example of what a man will come through who has a powerful, unsubduable constitution; I would take this very case as a warning, rather than an example, and give an opinion directly opposite to that of Verduc. Were a man of seventy years of age, his leg ulcerated to the bone for forty years, to have his leg not only fractured, but miserably crushed by a loaded carriage passing three times over it; and were there, in addition to the fracture of bones already carious, a violent hæmorrhagy! I would say, "It is not impossible this man may survive! We are met here in consultation, whether we shall or shall not amputate his limb, which implies that we know it to be possible that he may survive! we read in Verduc of such a case, in which the man lived; but his escape is reckoned by all judicious surgeons to be a miracle; and the more it is a miracle, the less is it an example. In that very case, the hæmorrhagies, the gangrenes, the sloughings, and the exfoliations, were such as put the man's life in daily jeopardy; and of the ten years he had to live, he lingered out two, in the filth and misery of a sick-bed. Therefore, notwithstanding this case, recorded by one of our most respected authors, I advise for this old man as I would judge in the case of my own parent, that the limb be cut off without delay."

Pott himself escaped with life after one of the worst compound fractures; yet Pott approves of amputation, and disapproves of Belguer's opinions, of his books, his practice, his translators, and abettors in this country. The most ingenious men differ on this important point; and there is a reason for that variety of opinions with which in your future studies you may be perplexed. One surgeon advises amputation, and gives alarming representations of the dangers attending a compound fracture; to him it appears, that the attempt to save a lacerated limb is almost certain death: But he is one who has practised in the hospital, or in the unhealthy suburbs of some great city, where the lower ranks of people swarm in filth and wretchedness, where in all seasons fevers and infection prevail. Another declares loudly against this destruction of limbs, declaims about the powers of nature and the constitution: But we find that he has practised among hale country men, labourers, workmen, and villagers, whose robust constitutions withstand every shock,

and who recover after being buried in quarries or the ruins of buildings, though dragged out but half alive. Another, who has practised in some great mercantile town, presents you with instances of the most extraordinary crushing, distortion, and mangling of the joints and bones ; relates cases where men little less mangled than if they had been broken on the wheel recover perfectly : But are we not to conclude, that such extraordinary cases are merely the exceptions to the general rule ? Those are the wonderful cases which obtrude upon our notice in every medical collection, yet they are rare and solitary instances of success, while the number of those who die is unknown ; their numbers, if fairly reckoned, would constitute the general rule ; but who has an interest in collecting examples of gangrene and sudden death ?

The army surgeons of different countries, and even of the same country, hold opinions directly opposite to each other. In one season or country, in one hospital, or after one particular battle, the men are healthy, the wounds heal as by miracle, and few amputations are required ; but in another battle, in unhealthy camps, in sickly seasons, in places where the men are exposed to cold, moisture, infection and want, all those whose limbs the surgeon attempts to save, perish.

You must be persuaded then, that in respect of this great and interesting point of practice, there can be no absolute rule in nature ; nor is it possible that any single man should be qualified, by practising in various climates, seasons and situations, by feeling in his very person all those influences, to lay down any absolute rule. No man of good sense will venture even to imagine himself capable of ascertaining this question, and the person the most inclined to establish absolute aphorisms on this difficult point, would be least of all entitled to the public confidence. Time, place and circumstance, always modify the question, and give a peculiar and individual character to each particular accident. Those who in their writings maintain the most opposite opinions, would not, I believe, debate one moment, if brought to the bedside of a patient to consult about a particular case.

It is with the hopes of awakening your attention to a great and important question that I have touched on it in this place, and it is to furnish you with matter for reflection that I have been at pains, through all this tedious volume, to lay before you, in a minute, particular, and somewhat of a dramatic form, the most ordinary accidents of practice. When such difficulties come upon you, read, reflect, retire within yourselves ! and may you, as you advance in years, have the

comfort of believing that you have, on every trying occasion, conducted yourselves with honour, integrity, and prudence : It is a happiness which, in our uncertain profession, no human wisdom nor diligence can absolutely ensure.

FINIS.

Printed by MUNDELL & SON, }
Royal Bank Close, Edinburgh. }

Bayerische
Staatsbibliothek
München

Bell, John,

The principles of surgery in two volumes

Bd.: 1

Edinburgh 1801

4 Chir. 6-1

urn:nbn:de:bvb:12-bsb10347778-3